BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

FILED
07/02/21
03:35 PM

Order Instituting Rulemaking Regarding Broadband Infrastructure Deployment and to Support Service Providers in the State of California	Rulemaking 20-09-001

OPENING COMMENTS OF CHARTER FIBERLINK CA-CCO, LLC (U-6878-C) AND TIME WARNER CABLE INFORMATION SERVICES (CALIFORNIA), LLC (U-6874-C) ON THE ASSIGNED ADMINISTRATIVE LAW JUDGE'S MAY 28, 2021 RULING

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July 2, 2021

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Charter Fiberlink CA-CCO, LLC (U-6878-C) and Time Warner Cable Information Services (California), LLC (U-6874-C),[1] submit these opening comments in response to the Assigned Administrative Law Judge's Ruling, dated May 28, 2021, issued in this proceeding ("ALJ Ruling").[2]

I. INTRODUCTION AND SUMMARY

The ALJ Ruling inquires whether "redlining" may exist as a result of systemic issues in the communications marketplace that disadvantage specific communities, and requests comments on several studies on the issue, in addition to allowing parties to offer their own data and analysis.

[1] Herein, the term "Charter" refers to the affiliates of Charter Fiberlink CA-CCO, LLC and Time Warner Cable Information Services (California), LLC. Charter reiterates its objection to the OIR's naming of its affiliates Charter Fiberlink CA-CCO, LLC (U-6878-C) and Time Warner Cable Information Services (California), LLC (U-6874-C), as respondents in these proceedings insofar as neither entity provides broadband services and so have no direct interest in, or relevance to, this proceeding. Opening Comments of Charter Fiberlink CA-CCO, LLC and Time Warner Cable Information Services (California), LLC at 22 n.55, R.20-09-001 (Oct. 12, 2020) ("Charter Comments"). Charter also reiterates its objections to the extent the OIR seeks to include Charter's cable affiliates as respondents. *Id.*

[2] *Order Instituting Rulemaking Regarding Broadband Infrastructure Deployment and to Support Service Providers in the State of California*, Assigned Administrative Law Judge's Ruling, R.20-09-001 (Cal. Pub. Utils. Comm'n May 28, 2021) ("ALJ Ruling").

Broadband Availability in California. Charter agrees with the underlying premise of the inquiry that every Californian should have reliable access to high-speed broadband, and the company is committed to helping close the digital divide and technology gap in unserved communities in the state. Charter also shares the state's goal of making 100 Mbps broadband available to all Californians and has demonstrated its commitment to expanding its footprint to unserved areas through billions of dollars in investments and participation in the California Advanced Services Fund ("CASF") infrastructure grant program.[3] As described below, Charter has deployed its high-speed services throughout its footprint at uniform prices, regardless of the racial or socioeconomic demographics that exist in the areas it serves.[4] Further, while the ALJ Ruling does not address broadband adoption, we note that Charter has prioritized promoting broadband adoption among low-income Californians and keeping these households connected to the internet.[5]

Moreover, thanks to robust capital investments and technological innovations made by Charter and other broadband providers, 100 Mbps broadband service or better is now available to the vast majority of Californians, especially in urban areas.[6] Charter has also deployed gigabit service throughout its California footprint.

Shortcomings of the Three Studies. Charter agrees that promoting the expansion and availability of high-speed broadband is a priority to all unserved areas regardless of demographics.

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[3] Charter Comments at 3-5 (describing recent rural deployment of broadband networks).

[4] *See* Section II.

[5] *See id.*

[6] *See* Section III. Charter also notes that the widespread availability of 100 Mbps service or better is due in large part to deployments by cable providers in the state, who collectively serve approximately 13 million households statewide. *See EOY 2019 CA Residential Fixed Broadband Deployment*, Tableau https://public.tableau.com/app/profile/cpuc/viz/EOY2019BBdeploymentbyCountyandZipCode/Dashboard (last updated June 16, 2021).

However, the Commission's own data shows that lack of broadband availability is primarily a *geographic*—as opposed to a demographic or income—issue. The most stark and consistent divide in broadband availability is between urban and rural areas. This is consistent with the Commission's data underlying Table 1 of the ALJ Ruling, which—although it appears to show a relationship between broadband availability and household income—actually shows a strong and direct correlation between broadband availability and *population density*, suggesting that rurality—not income—is the driving cause of the digital divide in California today.[7] Accordingly, it is critical for state and local agencies to clear a path to deployment by eliminating regulatory barriers and by updating proven subsidy programs to promote deployment to unserved areas.

By contrast, policy initiatives should not be based on flawed studies purporting to attribute the digital divide in California to "digital redlining." The ALJ Ruling seeks comment on three studies and whether they show that digital redlining is a systemic problem in California, as well as on a table comparing lack of broadband service to population size and median household income.[8] While it remains unclear exactly how "digital redlining" is meant to be defined, these three studies fail to support the notion that there is a "systemic issue" of "[i]nternet service providers (ISPs) . . . refusing to serve certain communities or neighborhoods," and particularly fail to support any such contention with regard to cable broadband providers like Charter.[9] Although the term "redlining" is susceptible to different interpretations and is not uniformly defined in the cited studies or the ALJ Ruling, Charter for purposes of these comments is treating the term as signifying the

[7] *See* ALJ Ruling at 4-5; *Underlying Data for Table 1 of Administrative Law Judge's Ruling*, Cal. Pub. Utils. Comm'n, https://www.cpuc.ca.gov/general.aspx?id=6442469319 (last visited July 1, 2021).

[8] ALJ Ruling at 2-5.

[9] ALJ Ruling at 1.

intentional discrimination in deployment of broadband services (and enhancements to those services, such as speed upgrades) based on income and/or race.

Importantly, the three studies on which the ALJ Ruling seeks comment do not show a systemic problem of wireline cable broadband providers failing to offer high-quality service to low-income and minority neighborhoods—Charter's deployments and network upgrades, as described below, make that point clear. To reach this conclusion, the studies ignore the widespread deployment of high-speed broadband using last-mile technologies other than fiber-to-the-premises ("FTTP") (particularly hybrid fiber coaxial ("HFC") networks deployed by cable providers) and the presence of strong and growing intermodal competition for broadband service throughout California.[10]

Charter's comments below focus primarily on the 2019 study published by USC Annenberg Research Network for International Communication and the USC Price Spatial Analysis Lab regarding FTTP deployments in Los Angeles County (the "2019 USC Study"),[11] and Questions 1-3 in the ALJ Ruling addressing these studies.[12] The 2019 USC Study directly addresses broadband deployment in Los Angeles County, where Charter offers service to the vast majority of county residents (and virtually ubiquitously in its franchised service area) and has deployed gigabit service throughout its footprint in the county.[13]

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[10] *See* infra notes 84 and 95.

[11] Hernan Galperin et al., *Who Gets Access to Fast Broadband? Evidence from Los Angeles County 2014-2017* (USC Annenberg, CCIG Policy Brief No. 4, Oct. 8, 2019), http://arnicusc.org/wp-content/uploads/2019/10/Policy-Brief-4-final.pdf ("2019 USC Study").

[12] Charter is not directly addressing Questions 4-8 from the ALJ Ruling within its own comments, but Charter supports the concurrently filed comments of the California Cable and Telecommunications Association regarding those questions, and reserves the right to address those question in reply comments.

[13] *See* Section II, below.

Charter's comments also focus on the 2019 USC Study because, of the three studies cited in the ALJ Ruling, the 2019 USC Study is the only one that includes a transparent methodology and attempts to use publicly available data to assess ISPs' deployment of high-speed broadband in California. By contrast, the Communications Workers of America ("CWA") and National Digital Inclusion Alliance ("NDIA") study focuses solely on FTTP deployments by AT&T, includes very little discussion of broadband deployment in California, and relies largely on anecdotal data from AT&T employees without attempting to address broader trends in broadband deployment.[14] Similarly, the Greenlining Institute study relies almost exclusively on anecdotal evidence, fails to disclose its statistical methodology, and does not offer any real data or analysis regarding digital redlining or the root causes of the digital divide.[15]

Although the 2019 USC Study is the most rigorous of the three studies, it provides no support for inferring that ISP choices in deploying their networks are a systemic problem in California because the study: (i) focuses exclusively on FTTP deployment as a proxy for broadband investment, which is not a complete (or even particularly informative) proxy for the availability of high-speed broadband services; (ii) incorrectly focuses on the number of local wireline competitors in particular neighborhoods, which is not a good proxy for whether broadband providers are offering Californians quality high-speed broadband options—the stated focus in this proceeding; and (iii) relies on stale deployment and competition data from 2014 to

[14] Communications Workers of America and National Digital Inclusion Alliance, *AT&T's Digital Redlining: Leaving Communities Behind for Profit* (Oct. 2020), https://www.digitalinclusion.org/wp-content/uploads/dlm_uploads/2020/10/ATTs-Digital-Redlining-Leaving-Communities-Behind-for-Profit.pdf ("CWA/NDIA Study").

[15] Vinhcent Le & Gissela Moya, *On the Wrong Side of the Digital Divide: Life Without Internet Access, and Why We Must Fix It in the Age of COVID-19*, Greenlining Institute (June 2, 2020), https://greenlining.org/publications/online-resources/2020/on-the-wrong-side-of-the-digital-divide.

2017. Beyond its methodological limitations, the 2019 USC Study, and the other studies, understate the availability of high-speed broadband from a variety of service providers, and overlooks non-discriminatory explanations for FTTP deployment patterns it observes.

Recommended Steps to Bridge the Digital Divide. The unrebutted record confirms that broadband availability is impeded by the high cost of deploying to more remote and sparsely populated areas and the existence of regulatory barriers that add unnecessary delay or increased costs that make new deployments economically unfeasible.[16] It is therefore critical that the Commission focus its efforts on encouraging deployments to unserved rural areas. By contrast, proposals from the studies to deploy government-owned networks would be highly inefficient and ineffective. The proposals to investigate and regulate broadband deployments risk leading the Commission to overstep jurisdictional boundaries. Further, existing data regarding the widespread availability of 100 Mbps and the lack of evidence for systemic redlining show that these efforts would be a misallocation of limited resources that could be better targeted toward directly bridging the digital divide. Charter encourages the Commission to focus on finding ways to help mitigate the high cost of rural deployment and eliminating regulatory barriers. These are proven strategies for expanding the availability of high-speed broadband and have ample support in the record.

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[16] *See* Charter Comments at 15-22; Reply Comments of Charter Fiberlink CA-CCO, LLC and Time Warner Cable Information Services (California), LLC at 3-4, 29 R.20-09-001 (Oct. 27, 2020) ("Charter Reply Comments"); Opening Comments of the California Cable and Telecommunications Association at 5-7, R.20-09-001 (Oct. 12, 2020) ("CCTA Comments"); Comments of Comcast Phone of California, LLC at 25-28, R.20-09-001 (Oct. 12, 2020) ("Comcast Comments"); Comments of Cox California Telecom, LLC at 7, R.20-09-001 (Oct. 12, 2020) ("Cox Comments"); Opening Comments of Frontier California Inc., Citizens Telecommunications Company of California Inc., Frontier Communications of the Southwest Inc., and Frontier Communications of America, Inc. at 6-7, R.20-09-001 (Oct. 12, 2020) ("Frontier Comments"); Opening Comments of Private Citizen Noah Aptekar at 9, R.20-09-001 (Oct. 12, 2020) ("Aptekar Comments"); Opening Comments of Electronic Frontier Foundation at 15, R.20-09-001 (Oct. 12, 2020) ("EFF Comments"); Comments of Crown Castle at 3-4, R.20-09-001 (Oct. 12, 2020) ("Crown Castle Comments").

II. CHARTER HAS DEPLOYED GIGABIT CONNECTIONS THROUGHOUT LOS ANGELES COUNTY, REGARDLESS OF RACE OR INCOME.

The 2019 USC Study fails to present an accurate and complete picture of the availability of robust broadband offerings in Los Angeles County. As discussed below in Section V, each of the three studies myopically focuses on FTTP deployment, ignoring the high-speed broadband offerings made available by cable and other broadband providers, including through highly efficient HFC networks.

As noted in the Brattle Study attached as **Exhibit A** to these comments, Charter provides nearly ubiquitous coverage Los Angeles County, covering 98.3% of the population at 200 Mbps baseline speed and offering maximum speeds up to 1 gigabit throughout the county.[17] Charter's deployment and network upgrades required a major commitment of resources and a commitment to equitably serving county residents.[18] Between 2016 and 2020, Charter invested approximately $40 billion in its network and technology nationwide,[19] including $842 million invested in infrastructure and technology in California in 2018 alone. Charter continues its efforts to expand its network in California and nationally. For example, Charter recently launched a new $5 billion initiative to expand broadband availability to over 1 million new unserved customer locations, nationally.[20] Charter also offers low-cost service plans such as *Spectrum Internet Assist* for

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[17] Coleman Bazelon & Paroma Sanyal, *Understanding Broadband Deployment: A Case Study of Los Angeles County*, Brattle Group (July 2, 2021) ("Brattle Study"), attached as Exhibit A at 22.

[18] *See* Declaration of Deborah Picciolo ("Picciolo Decl."), attached as Exhibit B, ¶ 3.

[19] *See* Press Release, Charter Communications, *Charter Announces First Quarter 2020 Results* (May 1, 2020), https://corporate.charter.com/newsroom/charter-announces-first-quarter-2020-results.

[20] *See* Press Release, Charter Communications, *Charter Communications Launches New Multiyear, Multibillion-Dollar Initiative To Expand Broadband Availability To Over 1 Million New Customer Locations* (Feb. 1, 2021), https://corporate.charter.com/newsroom/charter-communications-launches-new-multiyear-multibilliondollar-initiative-to-expand-broadband-availability-to-over-1-million-new-customer-locations.

qualifying households,[21] participates in the FCC's Emergency Broadband Benefit Program to provide discounted service to qualifying customers,[22] and it continues to participate in programs like CASF that are designed to accelerate deployment of high-speed broadband to unserved areas in the state.

Charter offers minimum download speeds of at least 200 Mbps to 100% of its households with broadband availability in Los Angeles County, regardless of income or demographics—including households in some of the most economically-disadvantaged communities in the county.[23] As of 2018, Charter's gigabit service is available to nearly all households in Los Angeles County.[24] The 2019 USC Study uses data that dates back to 2014, and even then Charter offered at least 100 Mbps service, which has only increased over time, as demonstrated in Charter's node boundary maps for Los Angeles County in Figure 1, below.

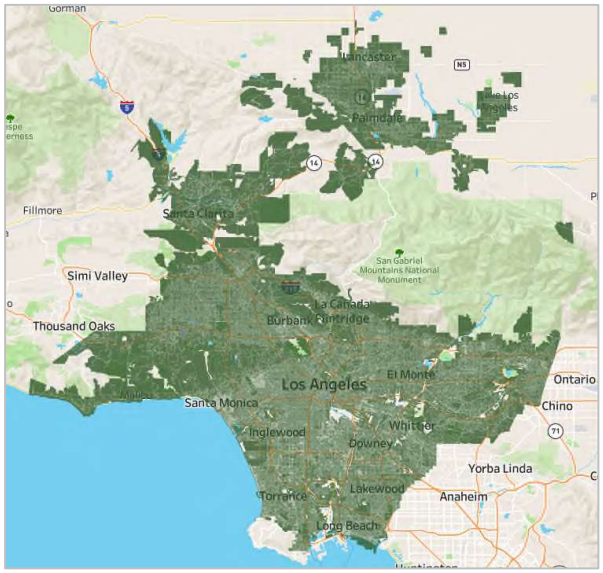
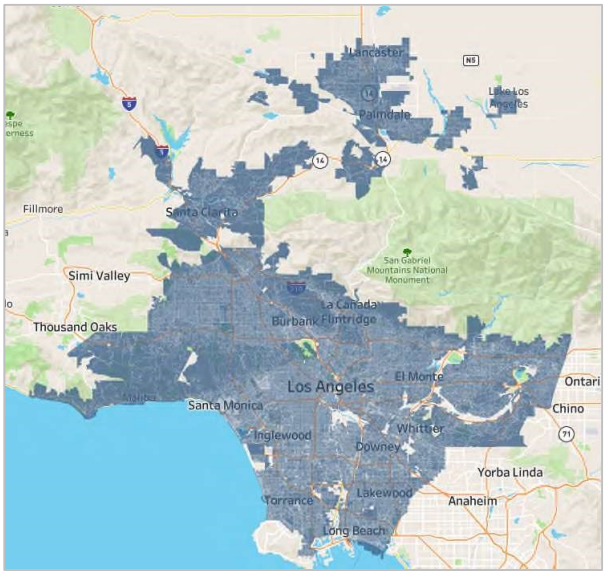
[21] *See Spectrum Internet Assist*, Spectrum, https://www.spectrum.com/browse/content/spectrum-internet-assist (last visited July 1, 2021).

[22] *See* Press Release, Charter Communications, *Charter Announces Participation in Emergency Broadband Benefit Program* (Apr. 1, 2021), https://policy.charter.com/Charter-Announces-Participation-Emergency-Broadband-Benefit-Program.

[23] *See Residential Rate Card Information & Disclosures*, Spectrum, https://www.spectrum.com/browse/content/ratecard (last visited July 1, 2021).

[24] The maps in Figure 1 represent node boundaries in Charter's service area. Charter serves almost all cities in Los Angeles County except for the City of Industry, Rancho Palos Verdes, Palos Verdes Estates, Rolling Hills Estates, Rolling Hills, and City of Vernon. There may also be instances in which Charter does not provide service to industrial areas, or is prevented by building owners from accessing multi-tenant buildings and mobile home parks, as discussed below.

Figure 1: Charter Broadband Availability Maps for Los Angeles County

Charter's Broadband Availability Map for Los Angeles County in 2020 (Max Consumer Download Speed 940-1,000 Mbps)	Charter's Broadband Availability for Los Angeles County in 2014[25] (Max Consumer Download Speed 100-499 Mbps)
	

Charter's efforts include deployment and network upgrades in low-income, predominantly Hispanic communities in East Los Angeles, Maywood, Huntington Park, and others, and historically Black neighborhoods in Compton, Watts, and South Los Angeles—communities that Charter has served for decades, and with gigabit service available as of 2018.[26] Charter's deployments and network upgrades in Compton, Watts, and South Los Angeles also directly show that the 2019 USC Study paints a highly misleading picture of broadband investment in those communities, by focusing narrowly on FTTP deployments as a proxy for broadband providers' investment and offerings in a given area. The images below are maps from the 2019 USC Study, which imply a lack of high-speed broadband in Compton, Watts, and South Los Angeles, because

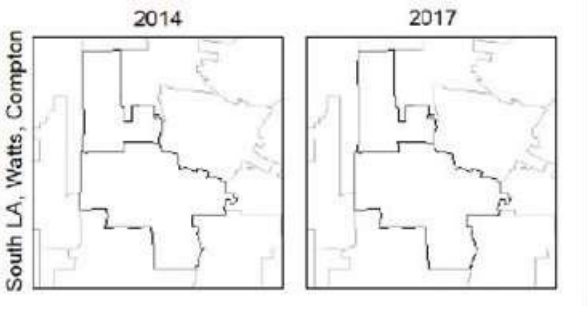
[25] The 2014 map shows the legacy service areas of both Time Warner Cable and Charter Communications prior to their 2016 merger.

[26] Picciolo Decl. ¶ 3.

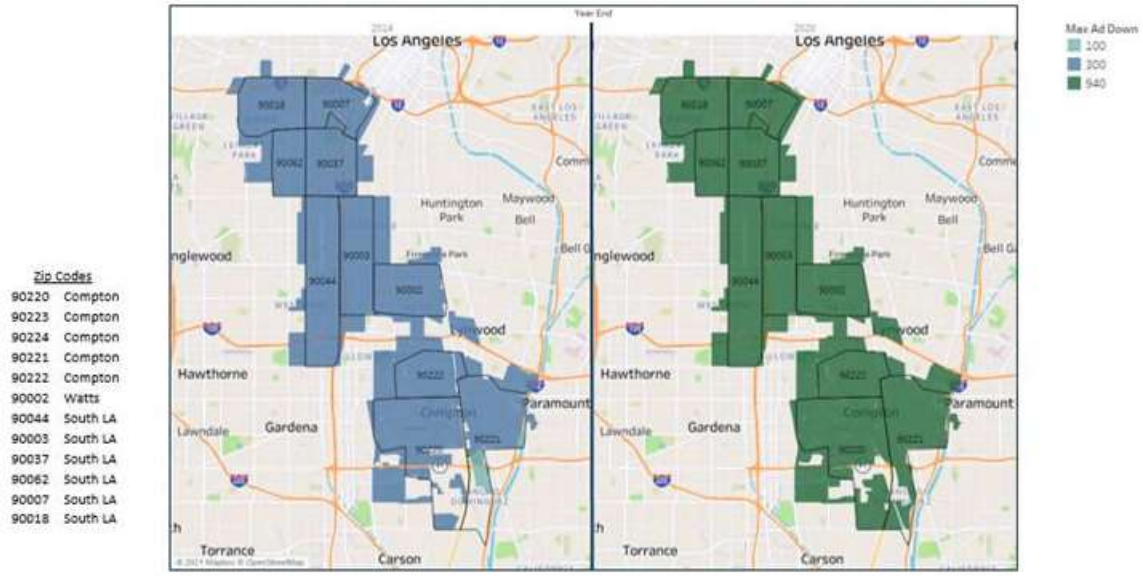
of lack of fiber availability, and below that are maps showing Charter's nearly ubiquitous deployment of high-speed broadband networks in those same areas.[27] The comparison makes clear that high-speed broadband is widely available in Compton, Watts, and South Los Angeles, contrary to the implication from the 2019 USC Study.

Figure 2: Maps Comparing Charter Broadband Availability Maps and 2019 USC Study Maps

2019 USC Study Portrayal of South, LA, Watts, and Compton, Comparing 2014 to 2017
(Focusing on Fiber Availability)



Maps Showing Ubiquitous Availability of Charter's Broadband Service
In South, LA, Watts, and Compton, Comparing 2014 to 2017



[27] As described above, there may be instances in which Charter does not provide service to industrial areas, or is prevented by building owners from accessing multi-tenant buildings and mobile home parks, as discussed below.

Moreover, the small sliver of Los Angeles County residents without access to Charter's services are, on average, much *higher*-income than average, and the share of Hispanic and Black population in those areas is well below the average for the County, as demonstrated in Table 1, below.

Table 1: State of Charter Broadband Service in Los Angeles County[28]

County Averages	Count of Blocks	Share of Blocks	Sum of Population	Share of Population	Population Weighted Median Income	Population Density (Pops / Sq. Mi)	Population Weighted Share of Hispanic Population (%)	Population Weighted Share of Black Population (%)
	109,582	100.0%	10,039,107	100.0%	$75,662	2,474	48.2%	8.0%
200 Mbps Download / 20 Mbps Upload								
Speeds Provided?	Count of Blocks	Share of Blocks	Sum of Population	Share of Population	Population Weighted Median Income	Population Density (Pops / Sq. Mi)	Population Weighted Share of Hispanic Population (%)	Population Weighted Share of Black Population (%)
Yes	96,900	88.4%	9,867,187	98.3%	$75,078	5,480	48.5%	8.1%
No	12,682	11.6%	171,920	1.7%	$111,723	76	27.4%	3.7%

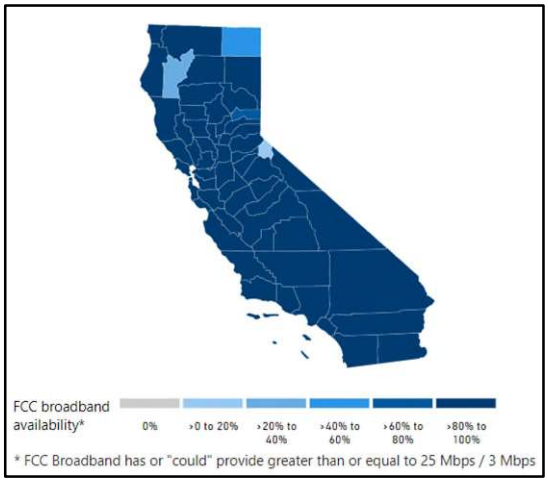
Charter also uses nationwide pricing for its broadband services, meaning that all California residents are offered the same prices and service packages and promotional broadband offerings, regardless of the community in which they live. Charter's non-discriminatory offerings and investments certainly counteract any implication of discrimination by Charter. And although Charter lacks unique insight into the basis for investments made by other broadband providers, Charter's own efforts certainly illustrate why the studies on which the ALJ Ruling seeks comment are flawed and cannot be relied on to infer that digital redlining—however it is defined—is a systemic problem.

[28] Brattle Study at 23.

III. 98 PERCENT OF URBAN RESIDENTS HAVE ACCESS TO 100 MBPS BROADBAND, AS DO 95 PERCENT OF HOUSEHOLDS STATEWIDE.

Deployment of 100 Mbps has grown exponentially since 2013, when 100 Mbps was available to just 54% of residents statewide.[29] The Commission's own fixed broadband deployment data indicates that, as of December 31, 2019, 94.5% of Californian's have access to 100 Mbps broadband service.[30] The 2021 USC study, referenced below, finds that 100 Mbps service is available to 98% of all residents in urban areas,[31] and 92% of the lowest-income households statewide.[32] Broadband availability is even more widespread at the 25/3 Mbps level, as demonstrated in Figure 3, below.

Figure 3: Broadband Availability in California, 2019-2020 (25/3 Mbps Service or Greater)



[29] Cal. Pub. Utils. Comm'n, *DIVCA Video, Broadband and Video Employment Report For The Year Ending December 31, 2016* at 3-4 (June 8, 2018), https://www.cpuc.ca.gov/uploadedFiles/CPUCWebsite/Content/About_Us/Organization/Divisions/Office_of_Governmental_Affairs/Legislation/2018/DIVCA%20Final%20Report%20June%208%202018a.pdf.

[30] *EOY 2019 CA Fixed Broadband Deployment Analysis By Population*, Cal. Pub. Utils. Comm'n, https://public.tableau.com/app/profile/cpuc/viz/EOY2019CAFixedBroadbandDeploymentAnalysisByPoppulation/County (last updated May 17, 2021) ("*2019 CA Analysis by Population*").

[31] Hernan Galperin et al., *How far is California from high-speed broadband Internet for all?* at 1 (USC Annenberg, CCIG Policy Brief No. 7, Jan. 2021), http://arnicusc.org/wp-content/uploads/2021/01/Policy-Brief-7.pdf ("2021 USC Study").

[32] 2021 USC Study at 1.

Los Angeles County, the subject of the 2019 USC Study, enjoys similarly high levels of broadband availability. As the Brattle Study finds, 100 Mbps service is available to 99.4% of Los Angeles County residents, and 200 Mbps service is available to 99.3%.[33] In addition, 25/3 Mbps service is available to 99.5% of the population of the county.[34]

Charter agrees that more should be done to encourage further deployment to unserved areas, but the fact that 100 Mbps is available to 98% of urban households statewide—and 92% of the lowest income households statewide as compared to 95% overall—undercuts the premise that discrimination in broadband deployment is a systemic problem.

IV. ALTHOUGH THE VAST MAJORITY OF CALIFORNIANS HAVE ACCESS TO AT LEAST 100 MBPS BROADBAND, SOME RURAL COMMUNITIES STILL LACK HIGH-SPEED BROADBAND AVAILABILITY.

In January 2021, the same authors of the 2019 USC Study released an updated study ("2021 USC Study"), using Commission data, which explains that one of the primary drivers of the digital divide is the gap between urban and rural areas.[35] This gap is driven by low population density, high deployment costs, and regulatory barriers. According to the most recent data, only about 67% of rural Californians have access to 100 Mbps broadband, compared to 98% of urban Californians.[36] While the number of rural Californians without broadband access has decreased significantly in recent years,[37] the divide between urban and rural areas is sizeable, and more should be done to promote rural deployment of high-speed broadband. In other words, the primary

[33] Brattle Study at 16.

[34] *Id*.

[35] *See generally* 2021 USC Study at 1.

[36] 2021 USC Study at 1; *but see 2019 CA Analysis by Population* (finding rural broadband availability for 100 Mbps is 48.3%). It is unclear why there is a difference in the data of the Commission and the 2021 USC Study data.

[37] Brattle Study at Section III.

driver of the digital divide is *geographic*, and not demographic or income, as implied by the three digital redlining studies.

These findings are also fully consistent with data underlying Table 1 in the ALJ Ruling, which strongly suggests that lack of broadband availability is more closely associated with geographic location (urban vs. rural) than median household income.[38] In other words, the *cause* is population density (and related deployment costs), not income level. The data shows that broadband availability is correlated with population density,[39] and population density happens to be correlated with median household income.[40] As a result, it is not surprising that Table 1 shows differences in broadband availability between communities with different levels of household median income. But on a close review, the data shows that population density is the driving factor.

Similarly, there is a strong correlation between lack of broadband availability and the *number of households* in a census designated place ("CDP") (which generally correlates with how rural a CDP is). The CDPs with the least number of households were far less likely to enjoy high levels of 100 Mbps availability than CDPs with the lowest median incomes. For example, of the 500 CDPs with the *least number of households*, less than a quarter (115) had 100 Mbps available to at least 90% of households, and less than a third (153) had 100 Mbps available to at least 75%

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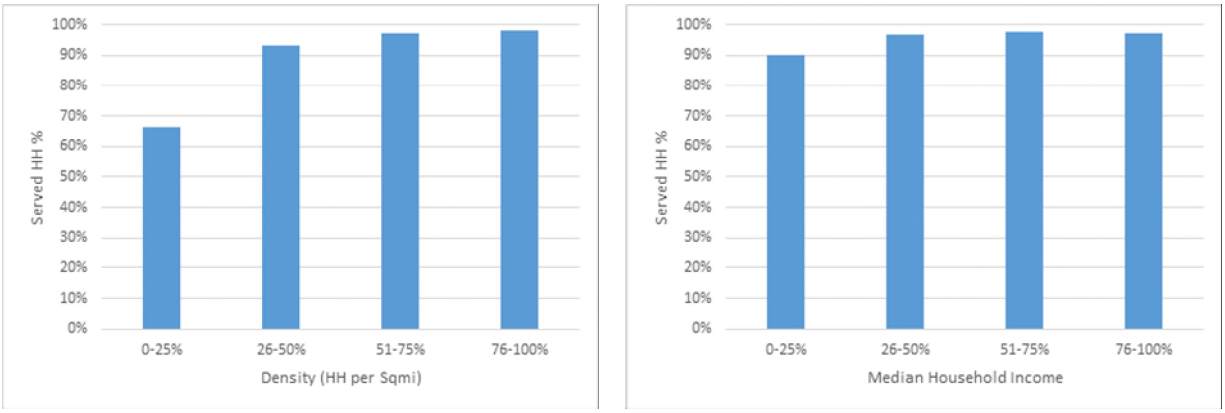
[38] *Broadband Infrastructure Deployment Proceeding (R.20-09-001)*: *Additional Information About Proceeding: Underlying Data for Table 1 of Administrative Law Judge's Ruling*, Cal. Pub. Utils. Comm'n, https://www.cpuc.ca.gov/general.aspx?id=6442469319 (last visited July 1, 2021) ("*Underlying Data for Table 1*").

[39] The Commission's data on "Served HH (%)" against a newly formed data set for "population density" by dividing Commission's data on "Total HH" by "Area Sqmi," yields a correlation between broadband availability and population density, with a correlation coefficient of 0.47, on a scale of -1 (absolute negative correlation) to 1 (absolute positive correlation). This correlation is stronger than comparing "Served HH (%)" against "median income" which yields a lesser correlation coefficient of 0.35.

[40] There is positive correlation (correlation coefficient of 0.16) between median household income and population density.

of households. In comparison, of the 500 CDPs with the *lowest median incomes*, nearly half (226) had 100 Mbps service available to at least 90% of households, and over half (264) had 100 Mbps service available to at least 75% of households. Figures 4 and 5 further illustrate this point, using the Commission's data referenced in the ALJ Ruling to show that broadband availability is much more strongly correlated with population density as opposed to median household income.

Figures 4 and 5: Bar Graphs Comparing Statewide Broadband Availability by Population Density and Median Household Income



This data strongly suggests that lack of broadband availability is more closely associated with geographic location (urban vs. rural) than median household income. And indeed, the Brattle Study finds that, in Los Angeles County, "density is the primary driver of broadband deployment, and income and socio-economic factors are of second-order importance or do not matter"[41] Census blocks with broadband coverage on average have a population density greater than 5,000 people per square mile, whereas uncovered areas on average have a drastically lower population density of approximately 30 people per square mile.[42] Residents in these low-density uncovered areas also have *higher* incomes on average than residents in high-density areas with coverage, indicating that

[41] Brattle Study at 31.

[42] Brattle Study at 15.

population density—rather than income—is the key driver of broadband deployment.[43] The Commission's data confirms that the least served CDPs are highly concentrated in counties such as those in the Central Valley, the area of the Sierra Nevada mountains, the coastal mountains in Santa Barbara County, and the Mohave Desert in the South, which are all difficult-to-serve low-density areas.[44] This is the availability gap on which the Commission's efforts would be most productively focused.

This result should be unsurprising given the basic economics of broadband deployment. Building out a broadband network requires significant capital investment.[45] Once the necessary facilities are in place, the cost of serving additional customers in that area is relatively low, giving providers a strong incentive to sign up new customers.[46] But for areas that are not already served, the fewer homes there are per mile in a given area, the less likely a provider will be able to recover the cost of deploying new facilities.[47]

As the record confirms, the high cost of deployment to rural areas is a major reason why this divide persists.[48] In many rural areas, it would simply be cost prohibitive for existing providers to deploy facilities.[49] The lower population density and more challenging terrain of rural areas (such as mountainous regions) are primary drivers of lower broadband deployment compared to

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[43] Brattle Study at 15.

[44] *See Underlying Data for Table 1*; Brattle Study at 13.

[45] Brattle Study at 8.

[46] *Id*.

[47] *Id*. at 8-9.

[48] Charter Reply Comments at 10-11.

[49] *See supra* note 16. *See also* Brattle Study at 9-10 (explaining that less densely populated areas are generally more expensive to serve, relying on FCC and Commission high-cost subsidy calculations).

more highly populated urban and suburban areas. Particularly for technologies such as HFC and fiber, greater geographical distance between customers results in very high costs for extending a network to an additional customer.[50] The inability to spread costs over a larger customer base reduces the economic feasibility of investing in broadband in rural areas.[51] A broadband provider has to connect the last mile over larger distances in rural areas than in urban areas.[52] Thus, even with a distribution network on the ground, the business case for serving an incremental rural customer may not be as strong as for a customer in a more densely populated area.[53]

By the same token, efforts to further examine allegations of systemic discrimination in broadband deployment cannot reasonably ignore the role that cost plays in the feasibility of deployment. Ongoing programs like CASF, the federal Rural Digital Opportunity Data Fund program, and other initiatives promise to help shrink this divide even further in the coming years by addressing, through deployment grants, subsidies to lower the capital cost of deploying broadband in less densely populated areas where a return on investment is otherwise infeasible.

Regulatory barriers also play a significant role in hindering new broadband deployment, in both rural and urban areas. As Charter and several other commenters have explained in prior comments, burdensome and inconsistent permitting processes at the state and local level, as well as inequitable practices by pole and conduit owners, often cause major delays in rural deployment projects.[54] In some cases, these regulatory barriers can prevent new deployments to unserved rural

[50] Brattle Study at 9.

[51] *Id*.

[52] *Id*.

[53] *Id*.

[54] Charter Comments at 16-20.

areas for several years or impose regulatory costs that exceed the construction cost for a given project.[55]

As several commenters have agreed, the Commission's efforts to close the digital divide should focus on mitigating the high cost of rural deployments and regulatory barriers that hinder deployment to unserved rural areas.[56] For example, Charter's project to provide broadband service to the City of Alturas in Modoc County has been stalled for years due to excessive permitting delays. Alturas is a community without access to high-speed broadband, and it remains so because of regulatory barriers beyond any provider's control.[57]

Moreover, any study that overlooks the role that cost and feasibility play in the digital divide is of highly limited value for the Commission's purposes and is incapable of accurately diagnosing the root cause of the digital divide. Relying on such studies will lead to flawed policies and only prolong the digital divide.

V. RESPONSES TO SPECIFIC QUESTIONS FOR COMMENT

- **Question 1: Are the inputs and assumptions of the studies discussed [in the ALJ ruling] accurate? How could one improve these studies?**

The 2019 USC Study bills itself as "prob[ing] for evidence that ISPs are neglecting investments in low-income areas and communities of color,"[58] and it purports to identify

[55] Charter Comments at 16 (Monterrey County), 20 (Los Angeles County).

[56] *See* Charter Reply Comments at 10-11; Opening Comments of AT&T California (U 1001 C) at 8, R.20-09-001 (Oct. 12, 2020); Opening Comments of The Corporation for Education Network Initiatives In California (CENIC) at 4-5, R.20-09-001 (Oct. 12, 2020) ("CENIC Comments"); Opening Comments of Next Century Cities at 7, R.20-09-001 (Oct. 12, 2020) ("NCC Comments"); Comments of The Utility Reform Network and The Center for Accessible Technology at 21-23, R.20-09-001 (Oct. 12, 2020).

[57] Charter Comments at 17.

[58] 2019 USC Study at 1.

disparities in broadband competition and FTTP deployment in Los Angeles County.[59] But the question presented here—*whether digital redlining is a systemic issue in California*—is actually beyond the scope of the study. On a closer look, the study has several limitations and cannot be used to infer that there is a systemic issue of ISPs refusing to serve certain communities or neighborhoods. As a practical matter, the study presents no showing of a specific company intentionally discriminating in its deployments, nor a showing of any discriminatory pricing. Three key limitations bear emphasis here from the study: (i) it focuses exclusively on FTTP as a proxy for broadband investment in communities and excludes the availability of high-speed offerings that use other technologies; (ii) it incorrectly uses the number of competitors as a proxy for quality of broadband service; and (iii) it relies on outdated deployment and competition data from 2014 to 2017.

1. The 2019 USC Study is skewed because it focuses exclusively on FTTP and excludes deployments using other technologies, including cable providers' hybrid coaxial fiber networks.

The 2019 USC Study focuses exclusively on FTTP deployment and does not consider the widespread deployment of HFC networks (and other broadband technologies) in Los Angeles County. Although the study attempts to evaluate whether there is "cherry-picking" in who gets access to "fast broadband," the study does not actually consider all sources of high-speed broadband. FTTP deployments are not a suitable proxy for broadband deployment in general, and so the study cannot be used to draw inferences about broader trends in the marketplace.

Focusing exclusively on FTTP deployment as a proxy for broadband providers' investment and offerings in particular neighborhoods or communities, therefore, represents a fundamental methodological flaw, because FTTP deployment is not a complete or even particularly informative

[59] 2019 USC Study at 1.

metric.[60] As an initial matter, the 2019 USC Study offers no real justification for its selective approach. And it is a strange methodological choice on its face, since the study relies on the Commission's dataset, which includes deployment data from all ISPs. The 2019 USC Study could have easily—and should have—drawn on other providers' data to analyze general trends in broadband deployment.[61] Focusing exclusively on FTTP is also a strange approach because broadband (defined in the study as 25/3 Mbps service or better) is offered using a variety of different technologies, the deployment of which is affected by different factors and involves different trade-offs.

Charter does not dispute that fiber plays an important and valuable role in many different networks. In Charter's HFC network, for instance, fiber is used for the vital links from the headend or hub to the node, and Charter is in the process of planning a significant deployment of FTTP facilities in several projects where it is engaged in altogether new construction to unserved rural areas. In those cases, the company is deploying an FTTP network, but in other cases, Charter has chosen to upgrade its HFC network to deliver more capacity and faster speeds.[62]

Contrary to the studies' enthusiasm for fiber, FTTP is not a silver bullet solution for ensuring ubiquitous broadband access at speeds that consumers want and need.[63] It is not always the most efficient or effective technology for making high-speed broadband service available, particularly in built-up markets, where an HFC network is already present.[64] In those markets,

[60] Brattle Study at Section IV.B.

[61] Brattle Study at 27 (explaining that "deployment and upgrade of a broadband network is a direct measure of investment and no proxy is needed to measure this").

[62] Picciolo Decl. ¶ 4.

[63] Charter Reply Comments at 20-21.

[64] Picciolo Decl. ¶ 5.

upgrading existing HFC facilities to enable higher speeds and lower latency is often the fastest and most efficient way to improve customer offerings.[65] The unprecedented surge of traffic during the pandemic was successfully handled by HFC networks in the United States, without any major interruptions or degradation of service or increases in price, further demonstrating the viability of HFC and the flaw in ignoring this technology when examining broadband deployment.[66]

By the same token, use of FTTP as proxy for broadband investment ignores Charter's extensive and equitable deployment of HFC throughout Los Angeles County. As discussed above, and as Figures 1 and 2 illustrate, this creates the false impression that various parts of the county are unserved when high-speed broadband is in fact available in those areas.[67] Moreover, FTTP is not necessary for "fast broadband"—at either 100 Mbps or gigabit speeds. For example, HFC networks can already provide gigabit service to customers, with a path to significant further speed increases in the coming years[68] and so there is no real justification for excluding HFC and other technologies capable of delivering these services from the discussion.

FTTP also has unique characteristics that makes it unrepresentative of broadband deployment as a whole. The technology is more costly to deploy than other technologies in many instances, as the Commission has observed and as the record confirms. As a result, FTTP is not a cost-effective approach for many projects due to the high cost of deploying fiber facilities. So the fact that providers may not deploy FTTP to a given neighborhood does not imply that they are excluding those neighborhoods from their deployments nor that such neighborhoods lack access

[65] Picciolo Decl. ¶ 5.

[66] *See* Charter Comments at 3.

[67] *See supra* Section II.

[68] *Driving Gigabit Speeds: From Lab to Consumer*, CableLabs (Fall 2018), https://www.cablelabs.com/insights/driving-gigabit-speeds-from-lab-to-consumer.

to high-speed broadband alternatives, such as HFC. The 2019 USC Study does not even acknowledge, let alone control for, the cost of FTTP deployment.

Moreover, FTTP only accounts for a relatively small fraction of broadband deployments in California today. According to the Commission's own data, less than a third of Californians are served by residential fiber.[69] By comparison, the vast majority of Californians are served by HFC networks, and broadband access over Charter's HFC network is available to virtually all households in Los Angeles County.[70] FTTP's share of the broadband market is simply too small to draw any conclusions about systemic problems in broadband deployment generally. Put simply, choosing not to deploy *FTTP* is very different from choosing not to deploy *broadband* to an area. If anything, the limited deployment of FTTP and the widespread availability of gigabit connections via HFC to date, only confirms that it is not a silver bullet for addressing the digital divide and should not be used to draw inferences about broadband deployment as a whole.

FTTP deployment is not a valid proxy for investment either, and for similar reasons. The economic trade-offs of FTTP (much higher deployment costs, lower maintenance costs, less signal degradation, and less power consumption) make it well suited for some deployment projects but not others.[71] This is due to factors unrelated to household income, including factors like availability of power, whether construction is new, and the feasibility of accessing necessary infrastructure.[72] In many markets, given the high deployment cost of FTTP, the most practical

[69] 2021 USC Study at 1 ("Overall, less than a third of Californians (31.5%) live in census blocks served by residential fiber, a modest increase from 29% in 2018.").

[70] *See EOY 2019 CA Residential Fixed Broadband Deployment,* https://public.tableau.com/app/profile/cpuc/viz/EOY2019BBdeploymentbyCountyandZipCode/Dashboard.

[71] Picciolo Decl. ¶ 6.

[72] Picciolo Decl. ¶ 6.

way to increase broadband speeds is to upgrade existing HFC facilities.[73] Charter's HFC facilities in Los Angeles County, for example, have been in place for decades, which made upgrading those facilities to support gigabit service the most efficient and cost effective approach in most instances.[74]

2. The 2019 USC Study incorrectly uses the number of competitors as a proxy for quality of broadband service.

Another methodological flaw in the 2019 USC Study is that it focuses on retail wireline competition as a proxy for whether providers are offering quality service in particular communities, effectively using competition as a proxy for access to high-speed broadband, service quality, and price.[75] As a result, the study starts from the unproved assumption that areas with fewer wireline providers competing for retail customers therefore lack access to high-quality broadband service and competitive prices.

The Commission's stated focus in this proceeding, however, is possible discrimination in the availability of high-speed broadband in low-income and minority communities—not the extent of retail competition in specific locations. And the relationship that the 2019 USC Study assumes—that areas with fewer wireline providers have less-desirable service offerings and prices—is simply not the case.

The reality on the ground, contrary to the implications from the 2019 USC Study, is that Charter has deployed high-speed broadband at uniform prices throughout Los Angeles County regardless of the number of competitors in a given area. The Brattle Study finds that

[73] Picciolo Decl. ¶ 6.

[74] Picciolo Decl. ¶ 6.

[75] 2019 USC Study at 3 ("low-income residents have fewer broadband options, which is typically associated with lower quality service and higher prices").

> Charter has ubiquitously upgraded its network for near Gig service across its service area, irrespective of the number of competitors or presence of a fiber competitor, implying that investment in its network is independent of the number of competitors/fiber presence.[76]

As discussed above, Charter offers industry-leading speeds throughout Los Angeles County and uses uniform pricing throughout its national footprint—meaning that Charter customers have access to high-speed broadband at the same prices regardless of whether there are two or more competitors in their census block. Charter also offers *Spectrum Internet Assist* and is participating in the FCC's Emergency Broadband Benefit Program throughout its California service area to help low-income customers stay connected regardless of where they live within Charter's footprint.[77]

Additionally, the 2019 USC Study conflates the number of wireline competitors with the quality and desirability of the available broadband services, ignoring that some markets can only support one or two providers based upon population density and demand. The absence of a third (or fourth or fifth) wireline provider in a given market, therefore, may often be a function of what the market can support, and should not lead to the implication that additional competitors are absent because of discrimination.[78] The 2019 USC Study ignores these kinds of considerations. Although it purports to control for competition intensity,[79] it does not actually do the work of analyzing why there might be relatively fewer competitors in certain areas.

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[76] Brattle Study at 27.

[77] *See Spectrum Internet Assist*, Spectrum, https://www.spectrum.com/browse/content/spectrum-internet-assist (last visited July 1, 2021); Press Release, Charter Communications, *Charter Announces Participation in Emergency Broadband Benefit Program* (Apr. 1, 2021), https://policy.charter.com/Charter-Announces-Participation-Emergency-Broadband-Benefit-Program.

[78] Brattle Study at 29.

[79] 2019 USC Study at 2.

3. The 2019 USC Study relies on outdated deployment and competition data from 2014 to 2017.

The 2019 USC Study is outdated and relies on stale deployment and competition data from 2014 to 2017. First, the Brattle Study, based on June 2020 data, shows that 100 Mbps broadband is available to 99.4% of the population in Los Angeles County. Second, USC Annenberg itself has since issued an updated study finding that "[t]he vast majority of Californians (94.2%) live in census blocks where residential broadband services with advertised speeds of at least 100/10 Mbps are offered,"[80] but that the main driver of the divide is the lack of availability in rural areas.[81] Based on this, the study concludes that public policy should focus on promoting competition and updating subsidy programs.[82]

Looking beyond FTTP deployment and broadband competition, the 2019 USC Study's dataset does not account for more recent developments indicating widespread upgrade of high-speed broadband in the county. For example, the Study's underlying dataset is too stale to account for Charter's nearly ubiquitous upgrade to gigabit service as of 2018.[83] The study also does not account for more recent deployments of high-speed broadband, including 100 Mbps 5G deployments by mobile wireless providers and 100 Mbps satellite networks (which is already available to approximately 99% of residents in Los Angeles County, with more satellite providers scheduled to offer service throughout California in the near future).[84]

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[80] 2021 USC Study at 1.

[81] 2021 USC Study at 1-2.

[82] 2021 USC Study at 5.

[83] *See supra* at 8.

[84] *See infra* note 96 (T-Mobile's 5G deployment commitments); *Satellite Internet in Los Angeles County*, SatelliteInternet, https://www.satelliteinternet.com/ca/los-angeles-county (last visited July 1, 2021) (reporting that Viasat offers up to 100 Mbps speeds to 99% of Los Angeles County); Paulina Duran, *SpaceX's Starlink Expects it Can Provide Global Coverage Around September*, Reuters (June 23, 2021), https://www.reuters.com/technology/spacexs-starlink-expects-it-can-

More recent data further undercuts the suggestion that competition levels are driven by race or median income. As the Brattle Study finds, "[t]here does not appear to be any correlation between the racial/ethnic composition of Los Angeles County and the number of competitors."[85] For example, census blocks with three or more providers offering 100 Mbps service have *higher* Black populations than areas with fewer competitors.[86] Competition levels also do not appear to be driven by median income, since census blocks with three or more providers of 100 Mbps service actually have a *lower* weighted median income than areas with fewer providers. Similarly, census blocks with three or more providers of 100 Mbps service have a lower median income than areas with only one such provider and areas that are unserved by 100 Mbps.[87]

Charter respectfully submits that the Commission's evaluation of broadband deployments should be based on the most recent data available and stresses none of the three studies cited in the

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provide-global-coverage-around-september-2021-06-22; *In re Inquiry Concerning Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion*, Fourteenth Broadband Deployment Report, 36 FCC Rcd 836, 851 ¶ 27 (2021) (finding "that satellite service offering 25/3 Mbps speeds is available to nearly all of the population"); David Jarvis, *The Satellite Broadband Industry Is Moving At Hyperspeed*, Deloitte Insights (Feb. 19, 2020), https://www2.deloitte.com/us/en/insights/industry/technology/future-of-satellite-internet.html (reporting on efforts by multiple companies "to build and deploy 'megaconstellations' of hundreds or thousands of satellites to bring affordable high-speed internet services to businesses, governments, schools, and individuals around the world"); David Anders, *Can Low Earth Orbit Satellites Bring Faster Internet To You? Here's The Latest!*, Allconnect (June 1, 2020), https://www.allconnect.com/blog/satellite-internet-gets-better-this-year; Press Release, Viasat, Inc., *Viasat Announces Highest-Speed, Unlimited Satellite Internet Service – Nationwide* (Feb. 27, 2018), https://www.viasat.com/news/viasat-announces-highest-speed-unlimited-satellite-internet-service-nationwide; Tariq Malik, *SpaceX's Starlink Broadband Service Will Begin in 2020: Report*, Space.com (Oct. 24, 2019), https://www.space.com/spacex-starlink-satellite-internet-service-2020.html; Adam Clark Estes, *The Pandemic is Speeding up the Space Internet Race*, Vox: Recode (Sept. 26, 2020), https://www.vox.com/recode/2020/9/26/21457530/elon-musk-spacex-starlink-satellite-broadband-amazon-project-kuiper-viasat.

[85] Brattle Study at 29.

[86] Brattle Study at 28, Table 3.

[87] Brattle Study at 28, Table 3.

ALJ Ruling (including the 2019 USC Study) track recent accelerations in broadband deployment, upgrades, and competition.

- **Question 2: Do the findings of these studies provide evidence of a systemic problem in California?**

The methodological flaws in the 2019 USC Study—particularly the narrow focus on FTTP to the exclusion of other broadband technologies—leave it incapable of supporting an inference of systemic digital redlining. But even accepting the study's flawed inputs, it does not provide any meaningful support for the proposition that there is a systemic problem of ISPs refusing to serve certain communities or neighborhoods. The 2019 USC Study overstates the significance of competition levels in light of Charter's widespread deployments in the county. The study also overlooks non-discriminatory explanations for the FTTP deployment patterns it observes, including cost (a major factor in FTTP deployments) and regulatory barriers. Finally, the 2019 USC Study understates the level of competition in the marketplace and is too stale to account for growing intermodal competition in today's broadband marketplaces.

1. The disparities reported by the 2019 USC Annenberg study do not support an inference of systemic discrimination in broadband deployment.

The 2019 USC Study reports that the odds of competition between two or more ISPs in a low-income census block group are below 70%, whereas those odds are above 75% in more affluent areas.[88] The 2019 USC Study reports similar disparities in traditionally Black neighborhoods in Los Angeles County as compared to areas with small shares of Black residents.[89] As discussed above, the study overstates and misapprehends the significance of how many wireline retail providers serve any given market. Consumers throughout Charter's footprint in Los Angeles

[88] 2019 USC Study at 3.

[89] 2019 USC Study at 2 (62% versus 73%, respectively).

County have access to high-quality broadband services at uniform prices regardless of whether there are two or more competing providers in the census block group.

2. The 2019 USC Study's findings regarding broadband competition are mistaken and ignore the availability of a broad range of broadband services.

Focusing on wireline broadband providers, the 2019 USC Study incorrectly finds "rapid consolidation of duopoly competition in the residential broadband market in LA County," with the implication that trends in competition between wireline providers is resulting in certain neighborhoods in Los Angeles County being left behind.[90] For all the reasons discussed above, that is simply not the case.[91] In addition, the 2019 USC Study's assessment of broadband competition is incorrect and fails to account for growth in intermodal competition. High-speed broadband is available to nearly all consumers in Los Angeles County, regardless of where they live, and consumers are gaining more options to choose from.

Over 75% of the population of Los Angeles County has 100 Mbps service available from at least two wireline providers. That is not to mention the presence of other, non-wireline ISPs.[92] Further, contrary to the implication of the 2019 USC Study, there does not appear to be any correlation within Los Angeles County between the racial composition of a census block and the number of competitors, as illustrated in Table 2, below.

[90] 2019 USC Study at 1.

[91] *See supra* Section II; Brattle Study at Section III.B.

[92] *See supra* note 84 and *infra* note 95..

Table 2: State of Broadband in Los Angeles County by Service and Provider Count[93]

County Averages	Count of Blocks	Share of Blocks	Sum of Population	Share of Population	Population Weighted Median Income	Population Density (Pops / Sq. Mi)	Population Weighted Share of Hispanic Population (%)	Population Weighted Share of Black Population (%)
	109,582	100.0%	10,039,107	100.0%	$75,662	2,474	48.2%	8.0%
At Least 25 Mbps Download / 3 Mbps Upload								
Number of Providers	Count of Blocks	Share of Blocks	Sum of Population	Share of Population	Population Weighted Median Income	Population Density (Pops / Sq. Mi)	Population Weighted Share of Hispanic Population (%)	Population Weighted Share of Black Population (%)
0	10,656	9.7%	47,094	0.5%	$81,079	24	32.2%	5.5%
1	35,273	32.2%	1,802,786	18.0%	$76,939	1,866	52.4%	8.1%
2	49,364	45.0%	5,903,988	58.8%	$76,303	6,764	50.6%	7.7%
3+	14,289	13.0%	2,285,239	22.8%	$72,903	8,460	39.0%	8.8%
At Least 100 Mbps Download / 10 Mbps Upload								
Number of Providers	Count of Blocks	Share of Blocks	Sum of Population	Share of Population	Population Weighted Median Income	Population Density (Pops / Sq. Mi)	Population Weighted Share of Hispanic Population (%)	Population Weighted Share of Black Population (%)
0	11,167	10.2%	56,607	0.6%	$79,796	26	33.8%	5.2%
1	41,352	37.7%	2,385,474	23.8%	$77,335	2,735	51.8%	8.2%
2	45,118	41.2%	5,670,082	56.5%	$75,707	7,159	49.7%	7.7%
3+	11,945	10.9%	1,926,944	19.2%	$73,357	8,644	39.5%	8.8%

Sources: Form 477 June 2020, 2010 Census Block Population and Area, ACS 2019 Estimates for median income, and share of black population and share of Hispanic/Latino population.

It is generally reasonable to look to wireline providers like HFC and FTTP providers when evaluating deployment of high-speed broadband, given that these technologies generally offer the fastest and most ubiquitous and reliable connections in the market. But focusing exclusively on wireline providers when assessing competition masks the reality that there are increasing options for high-speed broadband services more generally. Consumers, including low-income consumers, are increasingly able to access high-speed broadband through technologies like satellite and mobile wireless networks. Established satellite providers have deployed and continue to deploy low Earth orbit satellite networks to launch competitive 100 Mbps services.[94] Mobile broadband is also increasingly emerging as a high-speed broadband option. 100 Mbps mobile broadband will also be available to 99.0% of California's population within six years pursuant to binding commitments

[93] Brattle Study at 28.

[94] *See supra* note 84.

made to the Commission.[95] According to Pew Research, 80% of consumers without in-home broadband report that they are not interested in getting high-speed fixed broadband connections in their homes, with most respondents reporting that their "smartphone [does] everything they need."[96]

- **Question 3: Do these studies indicate discrimination based on race, socioeconomic status or otherwise, and, if yes, what are the societal implications?**

  1. None of the three studies supports the conclusion that discrimination in broadband deployment is a systemic problem in California.

For the reasons discussed above, the record is abundantly clear that Charter has deployed its high-speed broadband services equitably throughout its footprint in California, including in Los Angeles County, regardless of the racial or socioeconomic demographics of the neighborhoods it serves.[97] Furthermore, the data shows that the digital divide is primarily driven by the gap between

[95] *In re Joint Application of Sprint Communications Co. L.P. (U5112) and T-Mobile USA, Inc., a Delaware Corp., For Approval of Transfer of Control of Sprint Communications Co. L.P. Pursuant to California Public Utilities Code Section 854(a)*, A.18-07-011, Decision Granting Application and Approving Wireless Transfer Subject To Conditions, D.20-04-008 at 26 (Cal. Pub. Util. Comm'n Apr. 27, 2020). *See also In re Inquiry Concerning Deployment of Advanced Telecommunications Capability To All Americans in a Reasonable and Timely Fashion*, 2020 Broadband Deployment Report, 35 FCC Rcd 8986, 9032 ¶ 91 (2020) ("AT&T, T-Mobile, Sprint, and Verizon are also rapidly expanding their 5G deployment, with 5G networks in aggregate now covering more than 200 million consumers across the country, especially in urban areas, with more live launches planned for 2020."); *see* Verizon Communications Inc. (VZ) Q2 2020 Earnings Call Transcript, Motley Fool (period ending June 30, 2020), https://www.fool.com/earnings/call-transcripts/2020/07/24/verizon-communications-inc-vz-q2-2020-earnings-cal.aspx ("Remember, in February, we made some bold statements about our deployment of 5G in 2020, all the way from mobile edge compute, 5G Home [cities], [5x] more small cells on 5G and some 60 cities on 5G Ultra-Wideband as well as a nationwide coverage on 5G with DSS [dynamic spectrum sharing]. I'm happy to report, we're on track on that and in some cases[,] even ahead of the plan.").

[96] Monica Anderson, *Mobile Technology and Home Broadband 2019*, Pew Research Center (June 13, 2019), https://www.pewresearch.org/internet/2019/06/13/mobile-technology-and-home-broadband-2019.

[97] *See supra* Section II.

urban and rural areas and reflects the well-known barriers to rural deployment. In short, none of the studies support the conclusion that discrimination in broadband deployment, especially cable broadband deployment, is a systemic problem in California. For the reasons discussed above, and as Table 2 above shows using more recent data, the 2019 USC Study is far too limited to support such a conclusion,[98] and it relies on outdated data and flawed methodology.

The CWA/NDIA and Greenlining Institute studies suffer from the same limitations and are even less reliable for the Commission's purposes. The CWA/NDIA study focuses solely on the FTTP deployment by AT&T, and it includes very little data specific to California.[99] The question is whether digital redlining is a systemic problem in California and whether discrimination is a significant driver of the digital divide. The CWA/NDIA study adds nothing on these issues as it does not analyze broadband deployments generally or even focus on California.

The Greenlining Institute's study relies almost exclusively on anecdotal evidence and fails to disclose its statistical methodology. The report largely addresses why broadband access is important—something that is not in dispute here. But the study is thinly sourced and offers no real data or analysis on the scope of the digital divide and its root causes. Most relevant here, the Greenlining Institute study does not purport to show that digital redlining is a systemic problem in California and provides no real evidence to support such a conclusion.

2. The studies offer misguided suggestions, including spending taxpayer money to overbuild existing high-speed broadband networks, and bringing unlawful enforcement actions.

Because the studies either misdiagnose or ignore the root causes of the digital divide, they proffer misguided suggestions for how to bridge it. For example, the 2019 USC Study suggests

[98] *See supra* at 29.

[99] CWA/NDIA Study at 1-3, 5.

that government-owned networks ("GONs") may be a solution to the digital divide.[100] But as Charter has previously explained, subsidizing and developing GONs in areas that are already served would be an ineffective use of the Commission's time and limited resources.[101]

There is no evidence that the construction of GONs leads to lower prices. In fact, on average, cities or towns with GONs have had broadband prices 12% to 15% higher than municipalities without them.[102] The presence of a GON in a given area can also deter competition and distort local markets for broadband services because of local governments' ability to subsidize losses through taxes and bond issuances and charge competitors exorbitant fees.[103]

GONs are also poor vehicles for boosting local economies. Cities that deployed GONs on the promise of becoming the next technology hub have routinely been disappointed. Jobs in the "information sector" decreased in cities like Chattanooga, Tennessee and Lafayette, Louisiana after launching GONs.[104] Conversely, technology sector jobs boomed in cities without a GON, *e.g.*, Austin, Texas.

In any case, promoting a system of GONs to increase broadband deployment would be a long-term and costly project that cannot be carried out within the Commission's preferred timeframe of 12-18 months or faster, as compared to subsidy programs designed to promote deployment and adoption that have a proven track record.[105]

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[100] *See* 2019 USC Study at 5.

[101] Charter Reply Comments at 23-25.

[102] NCTA – The Internet & Television Association, *Government-Owned Networks Should Not Be Preferred for Government Support* at 2.

[103] Charter Reply Comments at 23-25.

[104] *Geographic Information*, U.S. Bureau of Labor Statistics, https://www.bls.gov/regions/economic-summaries.htm#TN (last visited July 1, 2021).

[105] Charter Reply Comments at 23-25.

GONs have also proved to be an ineffective and costly way to use taxpayer dollars to increase broadband access in several municipalities that have experimented with them, due to the combination of high capital and operating costs and lack of scale.[106] As one prominent study has explained as part of a comprehensive study of GONs, only two of the 20 GONs that have reported their financial results earn enough revenue to cover their development costs over a 30 to 40 year period.[107] 11 of these 20 networks generated negative cash flow, and of the 9 GONs that could eventually achieve solvency, it would take 60 or more years to do so, leaving taxpayers to foot the bill for decades.[108]

3. The studies ignore that, in the limited circumstances in which residents lack broadband connectivity, there may be barriers to deployment that are squarely within the control of state and local governments.

The 2019 USC Study also does not consider whether the FTTP deployment patterns it observes are driven by the cost of deployment or other factors that affect the feasibility of deployment; neither do the CWA/NDIA and Greenlining Institute studies. As the record already makes clear, new network deployment is simply not feasible in many instances due to factors beyond the provider's control.[109]

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[106] Charter Reply Comments at 23-25; NCTA – The Internet & Television Association, *Government-Owned Networks Should Not Be Preferred for Government Support* at 1.

[107] NCTA – The Internet & Television Association, *Government-Owned Networks Should Not Be Preferred for Government Support* at 1; Christopher S. Yoo & Timothy Pfenninger, *Municipal Fiber in the United States: An Empirical Assessment of Financial Performance* at 1 (Univ. of Pa. L. Sch.: Ctr. for Tech., Innovation and Competition 2017), 6611-report-municipal-fiber-in-the-united-states-an (upenn.edu) ("*Municipal Fiber in the United States*").

[108] Christopher S. Yoo & Timothy Pfenninger, *Municipal Fiber in the United States* at 1.

[109] Charter Comments at 15-22; CCTA Comments at 5-7; Comcast Comments at 26-27; Cox Comments at 7; Frontier Comments at 6-7; EFF Comments at 15; Crown Castle Comments at 3-5.

In addition to the high cost of deployment in many areas, construction of new network facilities is often hindered by burdensome and inconsistent permitting processes at the state and local level. Charter has previously described in detail the difficulties it has encountered in securing necessary permits from state and local agencies.[110] Some cities have also imposed unreasonable fees on broadband deployment, which has the same effect of hindering new deployment or making it unfeasible altogether. For example, the street damage restoration fee imposed by the City of Los Angeles requires payment of the cost to repave an entire street even if only a small portion was disturbed for an infrastructure project, which can run more than the entire cost of a project.[111]

Inequitable practices by owners of critical infrastructure—particularly utility poles and conduit—have also prevented broadband providers from bringing service to unserved communities. It is not uncommon for pole owners to refuse to act on Charter's pole attachment applications for months or demand unreasonable fees in response.[112] Property managers have also played a role in preventing deployments to unserved Californians. Charter has encountered many instances where property managers played a gate-keeping role and prevented Charter from accessing multi-dwelling units ("MDUs") and mobile home parks.[113] These decisions leave residents of MDUs and mobile home parks without access to broadband (or choice between providers), even though the necessary facilities could easily be deployed.[114]

Instead, consistent with the 2021 USC Study, Charter respectfully submits that the Commission's focus should be on removing barriers to deployment and updating proven subsidy

[110] Charter Comments at 15-20.

[111] *See* City of Los Angeles Municipal Code § 62.06.

[112] Charter Comments 21-22.

[113] Picciolo Decl. ¶ 7.

[114] Picciolo Decl. ¶ 7.

programs to accelerate deployments to unserved areas.[115] USC Annenberg acknowledged in its 2019 study that "municipalities can leverage their infrastructure assets . . . to promote private investments in underserved areas."[116] Charter agrees with the study to the extent it suggests that local governments should remove barriers to accessing rights-of-way so that ISPs can deploy networks. The Commission should also focus its efforts on making it easier for ISPs to deploy rather than imposing excessive fees and other barriers at each step of the deployment process. To that end, Charter has previously proposed the following proactive measures, which have broad support in the record:

- Adopting the pole attachment rule proposals set forth in the *Administrative Law Judge's Ruling Requesting Comments on "One-Touch Make-Ready" Requirements in California*, issued in Rulemaking 17-06-028 on March 9, 2021;
- Exploring whether and how to assert authority as a lead agency for California Environmental Quality Act ("CEQA") approval of broadband projects where other relevant government entities have declined jurisdiction, and designing a streamlined CEQA review process applicable in such circumstances;[117]
- Actively participating in regularly scheduled meetings with Caltrans to discuss communications infrastructure projects and ensure permit issuances are coordinated when multiple agencies are involved;[118]
- Using the Commission's position on the Broadband Council to encourage Caltrans to create a more transparent and predictable permitting process, including for design review;[119]

[115] *See* 2021 USC Study at 5.

[116] 2019 USC Study at 5.

[117] *See* Crown Castle Comment at 6; Opening Comments of Rural County Representatives of California at 5-6, R.20-09-001 (Oct. 12, 2020) ("RCRC Comments").

[118] *See* NCC Comments at 4-5; CENIC Comments at 3-4.

[119] CCTA Comments at 5-6.

- Convening workshops and assisting providers in coordinating with local governments to ensure that projects are not unreasonably delayed or deterred due to unreasonable costs, terms, or conditions;[120]

- Supporting the creation of a formal expedited complaint process in which service providers, including video franchisees, can request a declaratory ruling from the Commission in addressing unreasonable fees, terms, and conditions, with regard to unlawful local government permitting actions,[121] and supporting legislation to ensure such a declaratory ruling is binding on local governments;

- Issuing interpretive guidance clarifying that a pole owner's right to assess one-time reimbursement fees for "rearrangements performed at the request of the cable television corporation," Cal. Pub. Util. Code § 767.5(c)(1), does not entitle it to use pole replacements as opportunities to impose windfall charges; and

- Exploring ways to allow providers to deliver service to residents of MDUs and mobile home parks when property owners or property managers unreasonably deny access.

VI. CONCLUSION

Charter appreciates the Commission's efforts to ensure that all Californians have reliable access to high-speed broadband service. The record in this proceeding and the Commission's data show that the primary source of the digital divide is the relative lack of availability of 100 Mbps service in rural areas and that the gap between urban and rural areas is driven by the high cost of deployment and barriers to deploying to more remote and sparsely populated areas. For the reasons discussed above, none of the studies cited in the ALJ Ruling supports the conclusion that digital redlining is a systemic problem in California or a significant contributor to the digital divide. Charter therefore urges the Commission to focus its efforts on working with broadband providers

[120] *See* Cox Comments at 6-7.

[121] Such a process should be coupled with active Commission outreach to local governments to address efforts that exceed the Digital Infrastructure and Video Competition Act. The Commission set forth a process for telephone corporations to seek relief from unlawful municipal permitting action in D.98-10-058, and Charter asserts that the Commission should support a similar process for cable broadband providers.

to mitigate costs and reduce regulatory barriers to promote deployment to areas that truly lack broadband availability.

Dated: July 2, 2021

Respectfully Submitted,

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EXHIBIT A

Coleman Bazelon & Paroma Sanyal, *Understanding Broadband Deployment: A Case Study of Los Angeles County*, Brattle Group (July 2, 2021)

Understanding Broadband Deployment: A Case Study of Los Angeles County

THE BRATTLE GROUP

PREPARED BY

Coleman Bazelon
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PREPARED FOR

Charter Communications

2ND JULY, 2021

- This white paper was prepared for Charter Communications, in accordance with The Brattle Group's engagement terms, and is intended to be read and used as a whole and not in parts.
- The white paper reflects the analyses and opinions of the authors and does not necessarily reflect those of The Brattle Group's clients or other consultants. However, we are grateful for the valuable contributions of Ezra Frankel and Ryan Taylor.
- There are no third party beneficiaries with respect to this report, and The Brattle Group does not accept any liability to any third party in respect of the contents of this report or any actions taken or decisions made as a consequence of the information set forth herein.

TABLE CONTENTS

Executive Summary

This paper focuses on California, and particularly Los Angeles County, and comments on the current state of broadband in LA County, and responds to the CPUC's request for comments. We explain the economics of broadband deployment with its large sunk/fixed cost, a comparatively lower marginal cost, and revenue expectations that would justify the large fixed investment. We do not find a disparity in coverage or any support for an accusation of "cherry-picking". Contrary to the idea of entering richer neighborhoods first, we find that as providers build out to densely populated areas it is relatively wealthier rural areas that are left uncovered. We find that density is both a driver of competition (*e.g.*, as the population density of an area increases so too does the number of providers) and a driver of higher speeds (*e.g.*, as density increases, so too does the average speed advertised in LA County). Additionally, racial/ethnic composition and income do not appear to drive a provider's decision to add or remove service from a given census block. We also explain why it is misleading to use the number of providers or the presence of fiber as an indicator of broadband investment, and illustrate that investment, as measured by deployment and upgrades, is uncorrelated with the number of competitors or fiber.

I. Introduction

In the year and a half of the pandemic, broadband connectivity has rapidly taken on increased importance as a service, without which academic, business, and economic progress would stall. Now, more than ever, citizens are dependent on broadband access for everyday activities such as work, schooling, entertainment, and shopping. For this paper, we explore connectivity and deployment of fixed (wired) broadband networks, which have been the center of focus in recent years.

Despite the challenges of deploying fixed broadband service California's 2019 deployment data shows that 96.1% of Californians currently have access to fixed broadband at 25 Mbps download and 3 Mbps upload ("25/3 Mbps") or more (compared to the national coverage of 95.6%).[1] Approximately 94.5% of Californians have access to a 100 Mbps downstream fixed terrestrial broadband service as of 2019, and 92.3% have access to near gigabit service.[2] These results are expected to improve in the coming years. However, despite this overall success in broadband deployment, certain areas and communities still lack adequate access to broadband.

This gap in coverage, which is a part of the "digital divide," is an increasing concern for policy makers. The "digital divide" is a term often used to refer to uneven patterns in connectivity, access and use of digital resources across different demographic groups. While the term was originally focused on computer resources, it now generally refers to access to higher speed internet access. Although there are numerous aspects to the digital divide, most of the focus from policy makers has centered around two discrepancies: (1) the difference in connectivity and adoption between rural and urban areas; and (2) the difference in adoption rates between different demographic groups, notably between white Americans and Black and Hispanic/Latina

[1] California Public Utilities Commission, "EOY 2019 CA Fixed Broadband Data by County – Population," (Served Speeds >= 25/5 Mbps)", accessed June 29, 2021, https://public.tableau.com/app/profile/cpuc/viz/EOY2019CAFixedBroadbandDeploymentAnalysisByPopplation/County, ("CPUC 2019 Fixed Broadband Deployment"). For alternative deployment percentages and the national number see FCC, "2021 Broadband Deployment Report," adopted January 19, 2021, Appendix A, https://www.fcc.gov/document/fcc-annual-broadband-report-shows-digital-divide-rapidly-closing, ("2021 Broadband Report").

[2] "CPUC 2019 Fixed Broadband Deployment," (Served Speeds >= 100/20 Mbps)", (Served Speeds >= 900 Mbps DN)",

Americans. There are many reasons for the digital divide, but broadly, they fall into issues of availability and adoption.

We use the FCC and CPUC's threshold for adequate broadband services, which is currently set at 25/3 Mbps, to measure the digital divide as our base case.[3] This in no way presumes that any systematic differences between broadband deployments at higher speeds are not indicators of the digital divide. In fact, the CPUC's goal is to have 100 Mbps download speed as a threshold.[4] In this paper we show speed ranges from 25/3 Mbps to 940/10 Mbps and measure deployment at each tier. Additionally, we focus on cable/hybrid fiber cable (HFC) and fiber networks. We support the FCC's technology neutrality in providing broadband, but as a practical matter, fixed broadband will represent the lion's share of broadband connection.[5] Including other technologies would greatly complicate our analysis, but not change our basic conclusions.

With respect to the geographic digital divide, many rural areas still face challenges in availability of high-speed fixed access. In California, while 97.7% of the urban population has access to 25/3 Mbps broadband, only 71.4% of the rural population has access to internet at similar speeds. Most studies have focused on this geographic disparity in broadband availability, *i.e.*, the rural-urban divide, and policy solutions such as the Connect America Fund (CAF) and Rural Digital Opportunity Fund (RDOF) subsidy auction have been targeted towards narrowing this disparity.[6]

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[3] FCC, "2021 Broadband Deployment Report," adopted April 24, 2021, ¶ 2, https://docs.fcc.gov/public/attachments/FCC-20-50A1.pdf, ("2021 Broadband Deployment Report"). *See also* CPUC, "Order Instituting Rulemaking to Establish A Framework and Processes for Assessing the Affordability of Utility Service," Rulemaking 18-07-006, July 22, 2020, p. 27, https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M344/K049/344049206.PDF. Note that this is the FCC's definition of an "advanced telecommunications capability," and used to measure of the digital divide. See "2021 Broadband Deployment Report," ¶ 2.

[4] CPUC, "Order Instituting Rulemaking Regarding Broadband Infrastructure Deployment and to Support Service Providers in the State of California," Order Instituting Rulemaking, September 18, 2020, p. 2, https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M347/K278/347278341.PDF.

[5] OECD, "The Development of Fixed Broadband Networks," Directorate for Science, Technology and Industry Committee on Digital Economic Policy, Working Party on Communication Infrastructures and Services Policy, January 8, 2015, pp. 7-8, https://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=DSTI/ICCP/CISP(2013)8/FINAL&docLanguage=En, ("OECD Fixed Broadband Report"). See also Cable Labs, "What is DOCSIS 3.1 technology?" accessed June 30, 2021, https://www.cablelabs.com/technologies/docsis-3-1.

[6] Kevin Taglang, "What is the Rural Digital Opportunity Fund?" Benton Institute for Broadband & Society, February 14, 2020, accessed June 29, 2021, https://www.benton.org/blog/what-rural-digital-opportunity-fund, ("What is the Rural Digital Opportunity Fund?").

Until more recently, geographic disparities in broadband access within urban areas have received less attention.

There is evidence of a digital divide in the urban context as well.[7] The pandemic has increased concern about lack of connectivity in poorer neighborhoods and the emerging digital "homework gap" in urban areas. Studies show that reasons for this digital divide is different from that in rural areas, where the digital divide is first and foremost a lack of coverage issue, while in urban areas the digital divide is primarily an adoption story where cost, lack of digital literacy and education are the principal reasons for lower adoption rates.[8]

The California Public Utilities Commission (CPUC) has solicited comments on possible disparities in fixed broadband coverage based on income and race, and has opened an inquiry into these issues.[9] It seeks comments on three studies that purportedly show evidence of providers deploying higher speeds and deploying these earlier in richer non-Black neighborhoods. Specifically, the University of Southern California Annenberg study argues that the ISPs are *cherry-picking* areas for upgrades to fast broadband services in Los Angeles County, and upgrades are skewed against lower income neighborhoods and predominantly Black communities.[10] A study by the Greenlining Institute argues that there is a *digital divide*/lack of internet access in Fresno and Oakland and recommends California modernizing its Internet connectivity through ultra-fast "fiber" Internet infrastructure to all residents in certain areas and to offer subsidized Internet service plans.[11] Last, a study by CWA argues that AT&T is engaging in *redlining* and shows the lack of AT&T's fiber services and 25/3 Mbps services in lower income communities.[12]

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7 Alex Trollip, "Understanding the Urban Digital Divide," Bipartisan Policy Center, March 5, 2021, accessed June 28, 2021, https://bipartisanpolicy.org/blog/urban-broadband-blog/, ("Understanding the Urban Digital Divide").

8 "Understanding the Urban Digital Divide."

9 CPUC, "Order Instituting Rulemaking Regarding Broadband Infrastructure Deployment and to Support Service Providers in the State of California," Rulemaking 20-09-001, May 28, 2021.

10 Hernan Galperin and Thai V. Le, "Who Gets Access to Fast Broadband? Evidence from Los Angeles County 2014-17," Connected Cities and Inclusive Growth, Policy Brief No. 4, SLAB, USC Annenberg, September 2019, http://arnicusc.org/publications/who-gets-access-to-fast-broadband-evidence-from-los-angeles-county-2014-17/, ("Annenberg Study")

11 Greenlining, "On the Wrong Side of the Digital Divide," June 2, 2020, accessed June 29, 20201, https://greenlining.org/publications/online-resources/2020/on-the-wrong-side-of-the-digital-divide/, ("Greenlining Study").

12 Communications Workers of America and the National Digital Inclusion Alliance, "AT&T's Digital redlining: Leaving Communities Behind for Profit," October 2020, https://www.digitalinclusion.org/wp-content/uploads/dlm_uploads/2020/10/ATTs-Digital-Redlining-Leaving-Communities-Behind-for-Profit.pdf, ("CWA AT&T Report")

Additionally, the CPUC also seeks comment on the correlation between income and broadband deployment.

Both Greenlining and CWA studies claim that unavailability of fiber or lack of uptake of internet access in certain low income and/or Black neighborhoods is evidence of broadband service providers engaging in redlining activities. While disparities in broadband access are a genuine concern, we disagree that the differences are due to broadband companies engaging in redlining activities. As shown later in Section III, fixed broadband deployment is primarily driven by density and there is no systematic adverse bias (by race/ethnicity or income) in where broadband is made available, as illustrated by our analysis of LA County data. In this paper, we focus on the Annenberg study and LA County.

We first explain the economics of fixed broadband deployment and through that lens, interpret the deployment findings in LA County using the latest available data. We do not find evidence of redlining and cherry-picking in the County, but rather differences in broadband availability are primarily tied to population density. This paper is organized as follows: Section II describes the economics behind fixed broadband deployment and the digital divide, and shows how the evidence found in California and LA County illustrates these economic principles. Section III takes a deeper dive into the state of broadband deployment in California and LA County. Section IV responds to the findings in the Annenberg study and focuses on Charter's deployment, as it is one of the largest ISPs in LA County. Section V concludes.

II. The "Digital Divide" and the Economics of Broadband Deployment and Adoption

Disparities in internet access have both geographic and demographic dimensions, and the issue of access can be thought of as either "deployment/connectivity" or "adoption."[13] While expanding broadband deployment is a necessary condition for closing the digital divide, it is not a sufficient condition for adoption. The underlying causes driving deployment and adoption

[13] Congressional Research Services, "The Digital Divide: What Is It, Where Is It, and Federal Assistance Programs," updated March 2021, p. 1, https://crsreports.congress.gov/product/pdf/R/R46613, ("CRS Broadband Report, 2021").

require a two-pronged policy response – one set of solutions to target deployment issues and a second set to target adoption by consumers.[14] While the adoption/demand side of addressing the digital divide is important, the scope of this paper focuses on the prerequisite supply side of the digital divide, *i.e.*, the potential lack of adequate broadband deployment in certain areas and communities.

We acknowledge that given the methodology used to construct the Form 477 coverage data, these data can overstate coverage.[15] A much-critiqued feature of the Form 477 data is that it treats an entire census block as covered at a certain speed, even if only a portion of the census block was covered by that speed. We note that this is primarily a problem in rural areas, where census blocks are very large. In urban areas, the much smaller size of census blocks reduces any overstatement of broadband availability.[16] In general, for California, and particularly in LA County, the size of the census blocks, on average, are much smaller compared to, say, those in the more rural Riverside County. See Figure A8 and A9 in the Appendix. Thus using the FCC data to measure the digital divide in LA County should not lead to a large bias.

Before we analyze specific claims and data regarding the digital divide in California, we believe it is useful to explain some of the key economic forces driving broadband investment. Broadband is a classic capital intensive good. To provide a broadband service, a carrier needs to build a network before it can start offering service.[17] All networks require significant capital investments before the first customer can be covered. This has two important implications for understanding the economics of broadband markets. First, having built a network, the extra cost of serving an additional customer is low compared to the fixed costs, creating a strong incentive for operators to sign up customers once they have built a network. The basic economic principles behind a

[14] "What is the Rural Digital Opportunity Fund?" See also, FCC, "Lifeline Support for Affordable Communications," accessed June 30, 2021, https://www.fcc.gov/lifeline-consumers#:~:text=Lifeline%20is%20the%20FCC's%20program,participating%20wireline%20or%20wireless%20providers, ("Lifeline Support for Affordable Communications").

[15] Note that the new Form 477 data collection is aimed at correcting these flaws. See Benton Institute for Broadband and Society, "Congress Tells FCC to Fix Broadband Maps Now," Weekly Digest, March 27, 2020, accessed June 27, 2021, https://www.benton.org/blog/congress-tells-fcc-fix-broadband-maps-now.

[16] In general, in California there are not as many large rural blocks compared to other states, so the overstatement problem may not be as significant. See Appendix Maps B2 and B3 for a snapshot of average block size in in California around LA County and in Nevada. Note that the new Form 477 data collection is aimed at correcting these flaws. See Benton Institute for Broadband and Society, "Congress Tells FCC to Fix Broadband Maps Now," Weekly Digest, March 27, 2020, accessed June 27, 2021, https://www.benton.org/blog/congress-tells-fcc-fix-broadband-maps-now.

[17] Of course, a reseller can offer service by using *another* provider's network. We do not address resellers here as the FCC generally focuses on facilities based providers in terms of broadband service provision.

profit maximizing producer shows that the cost for producing an extra-unit of good or serving an extra home must at least be equal to the incremental cost of serving that home.[18] Low incremental costs mean it is profitable to cover a customer with low incremental revenue. Second given the large fixed cost, the expectation of revenue must justify the investment.

A. Cost Factors

It is well accepted that the cost structure for a fixed network depends on factors such as population density, residential patterns (single-family homes compared to apartment buildings) and terrain.[19] The lower population density and more challenging terrain of rural areas (such as mountainous regions) are primary drivers of lower broadband deployment compared to more highly populated urban and suburban areas. Particularly for technologies such as HFC and fiber, greater geographical distance between customers results in higher costs to extend a network to an additional customer. A cost study of broadband networks has found that "land-based networks exhibit economies of linear density; costs per customer covered is lower, the larger the number of customer locations per link distance (*e.g.*, miles)."[20] The inability to spread costs over a large customer base reduces the economic incentives for companies to invest in wired broadband in rural areas. A broadband provider has to connect the last mile over larger distances in rural areas than in urban areas. Thus, even with a distribution network on the ground, the business case for serving an incremental rural customer may not be as strong as for an urban customer.[21]

The fact that less dense/rural areas are more expensive to cover, all else equal, is corroborated by the subsidies awarded by the FCC and CPUC to cover high-cost areas.[22] For instance, in 2019,

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[18] Leibniz, "The Economy," CoreEcon, Based on Malcolm Pemberton and Nicholas Rau. 2015. Mathematics for economists: An introductory textbook, 4th ed. Manchester: Manchester University Press, accessed June 30, 2021, https://www.core-econ.org/the-economy/book/text/leibniz-07-06-01.html.

[19] "OECD Fixed Broadband Report," p. 27.

[20] Steve G. Parsons and James Stegeman, "Rural Broadband Economics: A Review of Rural Subsidies," CostQuest, 2018, accessed July 1, 2021, p. 10, https://www.ntca.org/sites/default/files/documents/2018-07/CQA-RuralBroadbandEconomics-AReviewofRuralSubsidies_FinalV07112018.pdf, ("Rural Broadband Economics").

[21] João Paulo Ribeiro Pereira, "Broadband Access and Digital Divide," New Advances in Information Systems and Technologies, March 3, 2016, pp. 363 – 368, https://link.springer.com/chapter/10.1007/978-3-319-31307-8_38.

[22] "Lifeline Support for Affordable Communications." *See also* "California Advanced Services Fund," accessed June 30, 2021, https://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/Utilities_and_Industries/Communicati

the FCC awarded approximately $4.9 billion to rate-of-return carriers to cover/expand/upgrade service to 455,000 households and business.[23] On average, that is approximately $10,000 per home, covered by a mix of copper, cable, HFC and fiber.[24] A study on the relationship between density and deployment estimates that "the investment per active subscriber is approximately $5,000 with linear density levels of 20 houses per road mile," and with large portions of the U.S. having even lower densities, the cost of deployment will be even greater.[25]

B. Revenue and Profitability Expectations

The demand side of the digital divide is somewhat interwoven with the supply side factors. For a broadband provider, the decision to enter a market, or expand into additional parts of a market, are contingent on having a high expectation that the carrier will earn enough to cover the fixed costs of entering the market. The expectation of revenues critically depends on the take-up rate, *i.e.*, the percentage of homes passed by the network that actually subscribe to services, which in turn depends on a host of demographic and socio-economic factors such as density, income, customer preferences, digital literacy and so on.[26] For example, explaining the economics of deployment, a Pew report states "providers invest in the urban and suburban areas where many potential customers live close together and have the disposable income to pay for service."[27]

A fixed network must generally be built out past every home in a community, whether that home takes the service and generates revenue or not. Its costs therefore are relatively insensitive to the number of subscribers, but its revenues are not. Less dense and rural locations "can cost substantially more to connect depending on how far the home or business is away from

ons - Telecommunications and Broadband/CASF%20Fact%20Sheet%20February%202021.pdf, (""California Advanced Services Fund").

[23] FCC, "2020 Broadband Deployment Report," GN Docket No. 19-285, adopted April 20, 2020, ¶ 66, https://docs.fcc.gov/public/attachments/FCC-20-50A1.pdf.

[24] Subsidy per Home = Total Subsidy/ No. of Homes Served =- $4.9 billion/ 455,000= $9,890 approximated to $10,000 in the text.

[25] Note: This assumes a household take rate of 35% (*i.e.* 35% of the homes passed subscribe to the service), See "Rural Broadband Economics," p. 21-22.

[26] "OECD Fixed Broadband Report," pp. 27-28.

[27] Pew, "How Much Broadband Speed Do Americans Need?" November 30, 2020, accessed July 1, 2021, https://www.pewtrusts.org/da/research-and-analysis/articles/2020/11/30/how-much-broadband-speed-do-americans-need.

connections at utility poles or pull boxes."[28] Rural areas, which tend to be less densely populated, combined with the "challenging terrain and lower incomes increase the cost of network deployment and entry, thereby reducing the profitability of providing service."[29] These factors increase both fixed and incremental costs. The combination of high fixed and marginal costs and low marginal revenue makes rural areas harder to cover. In contrast, even in the low-income areas of a city, the density dictates lower marginal costs. As a result, when the expected marginal revenue is low due too socio-economic factors, the lower marginal cost of service implies that even low-income neighborhoods in cities have a greater likelihood of being covered than their rural counterparts.

Given the discussion on the cost and revenue factors in the wired broadband industry, an expected outcome is a limited number of providers in a particular geographic area. As explained earlier, one of the primary distinguishing factors for broadband networks compared to the production of regular goods is the high level of sunk/fixed cost required. The fixed costs must be recovered for a provider to remain in business. Multiple networks create increased fixed costs that need to be recovered. Consequently, total revenue available in a market (or submarket) will limit the number of competing networks.

The economics of broadband networks also mean that significant competition can develop between two, or a few, networks. In urban areas, low marginal costs make competitive pricing profitable. In addition, some providers like Charter, have national pricing and in general, the prices for various broadband offerings are not based on local competitive conditions, but on the competitive areas in its national footprint.[30] In addition, intermodal competition from mobile broadband can also discipline the market.

[28] Otelco, "Lightwave Fiber Infrastructure Where, When, Why, and How," June 1, 2018, Accessed June 30, 2021, https://www.otelco.com/fiber-infrastructure/.

[29] For example, for Charter see https://www.spectrum.com/browse/content/ratecard.

[30] There are locals promotions and save desks that may lower price in some areas for a limited period of time.

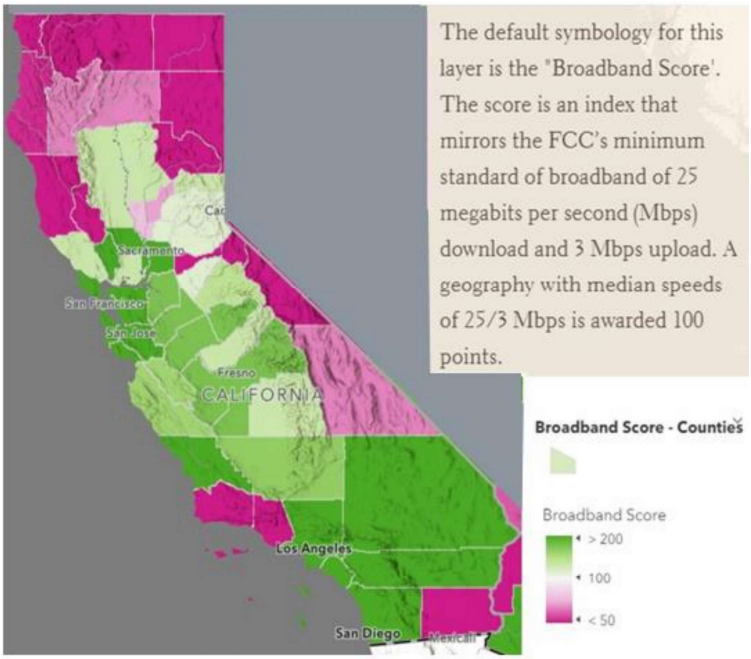
III. Evidence from California and Los Angeles County Demonstrate Population Density Drives Broadband Availability

From the discussion above, it is clear that an important part of costs and expected revenue in fixed broadband deployment is density driven. In this section, we illustrate that point for California and LA County. We will briefly discuss some high-level observations for California that confirm the relevance of density and then examine LA County, as that is the focus of the Annenberg study.

A. Evidence from California

Figure 1 below shows the state of broadband deployment in California.[31]

FIGURE 1: CALIFORNIA BROADBAND MAP 2020



Source: See https://storymaps.arcgis.com/stories/e6d25b67ec0b45978f8c5f225e266e94.
Note: Based on FCC 2020 data, the broadband score provides a visual representation of access to various levels of broadband service.

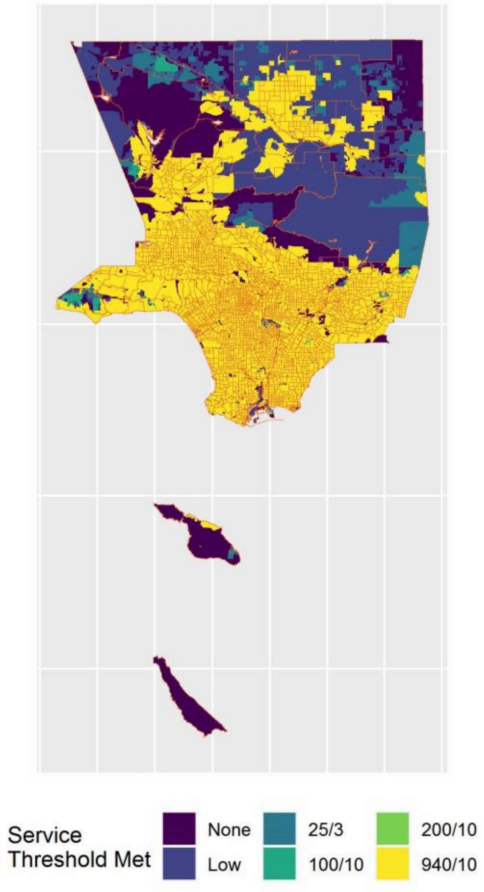
[31] Patrick Ryan, Broadband Availability and Adoption," Esri, accessed June 26, 2021, https://storymaps.arcgis.com/stories/e6d25b67ec0b45978f8c5f225e266e94, ("Esri Broadband Map 2020").

Based on a county level geography we find that the more rural and mountainous areas of Northern California, such as the Redwood National Park and the coastal mountain in the North-west and North, the area of the Sierra Nevada mountains, the costal mountains in Santa Barbara county and the Mohave desert in the South are all difficult to cover low density areas and also lack adequate broadband connectivity.

B. Evidence from Los Angeles County

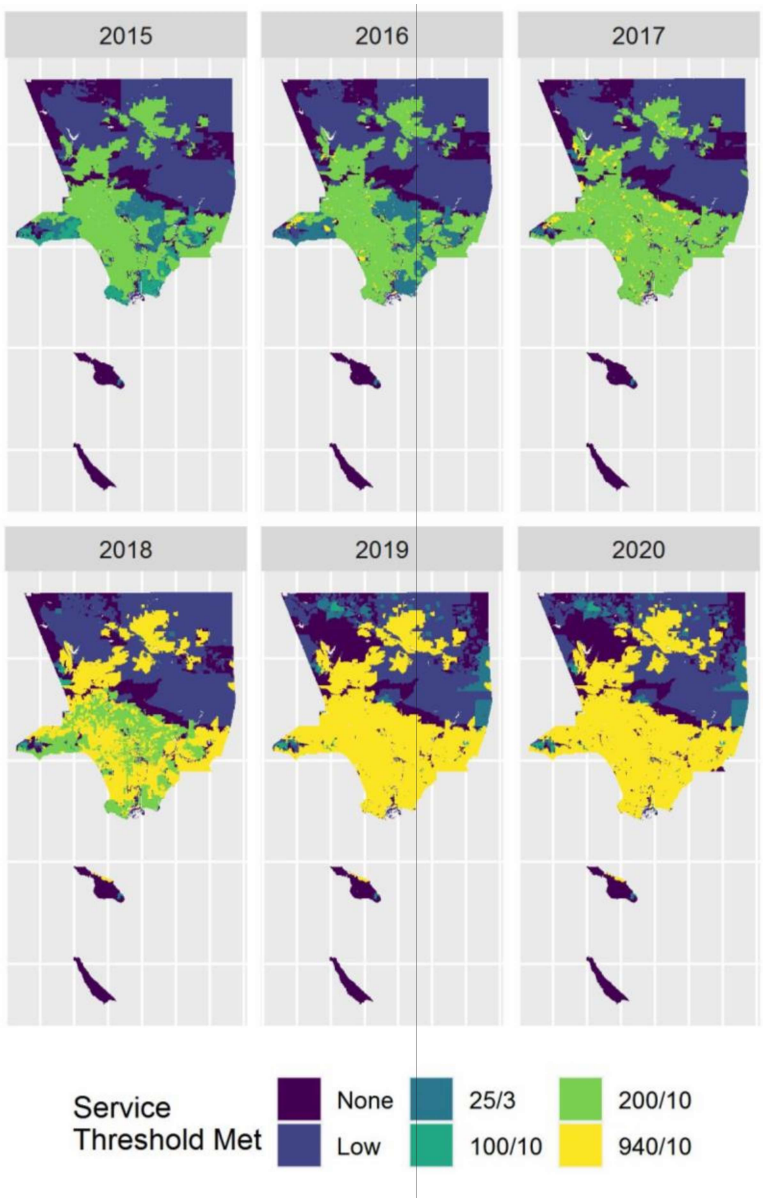
Figure A1 in the Appendix shows the LA County map and the map below shows fixed broadband deployment in LA County at various speeds. We observe that there can be significant variations in broadband deployment within the county, with the northern half of the county showing swaths of uncovered areas, whereas the southern half has near gigabit (940 /10 Mbps) speeds. Figure 3 shows the speed upgrades for LA County from 2015 – 2020.

FIGURE 2: LOS ANGELES COUNTY BROADBAND MAP 2020



Sources: FCC June 2020 Form 477 data; US Census TIGER Files.

FIGURE 3: ALL PROVIDERS' SERVICE OVER TIME, 2015 - 2020



Sources: FCC Form 477; US Census TIGER Files.
Notes: Census Blocks with only water area are excluded from the map.

To verify whether the cost and socio-economic factors discussed earlier can explain the deployment disparities in LA County, we implement a simple visualization of areas uncovered at 25/3 Mbps and correlate them with population density and income. Figure A2 and Figure A3 in the Appendix, are maps of Los Angeles County that show the population density and median income, respectively, of areas that are not covered by 25/3 Mbps from 2015 – 2020. These maps make two critical set of observations, one that can be generalized and one that may be specific to Los Angeles County. The first is that the areas that are not covered at 25/3 Mbps are relatively

more rural areas within the county and most have population densities below 10 people per square mile. Additionally, the maps show a closing of the availability gap between 2015 and 2020.

The second observation that may be more specific to LA County, based on Figure A3, is that those relatively rural areas also appear to be home to relatively wealthier residents. In LA County, the density story appears to dominate the income story, *i.e.* even wealthier areas with low population densities are uncovered.

Today, broadband access in Los Angeles County is nearly ubiquitous. Table 1, below, summarizes broadband coverage at the census block level in the county at various levels of download and upload speeds and contextualizes that coverage using a set of demographic indicators including population density, income, and racial and ethnic composition.[32] Using the most recently produced FCC broadband coverage data, we find that 99.5% of the population in the county has broadband service of 25/3 Mbps. 99.4% of the population is covered by an improved 200 Mbps download and 10 Mbps upload ("200/10 Mbps") with a similar percentage of the population receiving near gigabit services. To the extent that some population remains uncovered, this seems to be largely a function of population density. Covered census blocks on average have a population density of greater than 5,000 people per square mile. Uncovered areas, meanwhile, have a population density that is drastically lower, about 30 people per square mile. Moreover, residents of those low density uncovered areas have higher incomes than the high density covered areas implying that population density, and not low income, is the key driver of broadband deployment in LA County. On average, there is not a systematic relationship between racial/ethnic composition and broadband coverage. That is, an increased share of Hispanic/Latina or Black population does not appear to correlate with a decrease in connectivity.

[32] Note that analysis in this table and elsewhere relies upon broadband coverage data at the census block level, whereas the demographic indicators are reported by ACS at the census block group level (the smallest geographic unit at which demographic data is available). We apply the census block group demographic indicators to the underlying census blocks and when applicable, weight demographic indicators by census block population. We recognize that census block group demographics may not perfectly reflect the demographics of each underlying block, but we expect that this error would not bias our findings in any meaningful way. For example, at 25/3 Mbps, approximately 90% of the population of LA county falls within census block groups for which all of the underlying census blocks are covered. For the remaining 10% of population in census block groups that are not completely covered, the only potential error would be to the extent that the demographic pattern of the census blocks within a given census block group show variation. This potential error will be small and not alter the conclusions of this analysis.

TABLE 1: STATE OF BROADBAND IN LA COUNTY BY LEVEL OF SERVICE 2020

County Averages	Count of Blocks	Share of Blocks	Sum of Population	Share of Population	Population Weighted Median Income	Population Density (Pops / Sq. Mi)	Population Weighted Share of Hispanic Population (%)	Population Weighted Share of Black Population (%)
	109,582	100.0%	10,039,107	100.0%	$75,662	2,474	48.2%	8.0%
At Least 25 Mbps Download / 3 Mbps Upload								
Speeds Provided?	Count of Blocks	Share of Blocks	Sum of Population	Share of Population	Population Weighted Median Income	Population Density (Pops / Sq. Mi)	Population Weighted Share of Hispanic Population (%)	Population Weighted Share of Black Population (%)
Yes	98,926	90.3%	9,992,013	99.5%	$75,639	4,737	48.3%	8.0%
No	10,656	9.7%	47,094	0.5%	$81,079	24	32.2%	5.5%
At Least 100 Mbps Download / 10 Mbps Upload								
Speeds Provided?	Count of Blocks	Share of Blocks	Sum of Population	Share of Population	Population Weighted Median Income	Population Density (Pops / Sq. Mi)	Population Weighted Share of Hispanic Population (%)	Population Weighted Share of Black Population (%)
Yes	98,415	89.8%	9,982,500	99.4%	$75,641	5,290	48.3%	8.0%
No	11,167	10.2%	56,607	0.6%	$79,796	26	33.8%	5.2%
At Least 200 Mbps Download / 10 Mbps Upload								
Speeds Provided?	Count of Blocks	Share of Blocks	Sum of Population	Share of Population	Population Weighted Median Income	Population Density (Pops / Sq. Mi)	Population Weighted Share of Hispanic Population (%)	Population Weighted Share of Black Population (%)
Yes	98,048	89.5%	9,975,227	99.4%	$75,624	5,384	48.3%	8.0%
No	11,534	10.5%	63,880	0.6%	$82,353	29	34.4%	5.0%
At Least 940 Mbps Download / 10 Mbps Upload								
Speeds Provided?	Count of Blocks	Share of Blocks	Sum of Population	Share of Population	Population Weighted Median Income	Population Density (Pops / Sq. Mi)	Population Weighted Share of Hispanic Population (%)	Population Weighted Share of Black Population (%)
Yes	98,031	89.5%	9,973,394	99.3%	$75,625	5,385	48.3%	8.0%
No	11,551	10.5%	65,713	0.7%	$81,964	30	34.2%	5.0%

Sources: Form 477 June 2020, 2019 FCC estimates for Census Block Population, 2010 Census Block Area, ACS 2019 Estimates for median income, share of Black population, and share of Hispanic/Latina population.
Notes: Census block group demographic information is joined uniformly at the block level. Satellite providers are excluded. Weighted averages weight census block group demographic information at the census block by 2019 population of census block. We rely upon 2019 demographic data, the most recently produced at the census block group level, when summarizing 2020 FCC Form 477 data.

IV. Comments on the Findings in the Annenberg Study

We focus on four of the findings in the Annenberg study:

- *The Annenberg study argues that providers are engaged in "cherry-picking" neighborhoods to invest in*: The authors argue that there is a disparate availability of broadband because of race and income, and state that "Internet Service Providers"

("ISPs") are "cherry-picking areas for upgrades to fast broadband services" and "about a quarter of South LA residents remained without broadband choice in 2017." [33]

- *The Annenberg study uses broadband competition and availability of fiber as proxies for Investment, and reports that low income and Black neighborhoods have low investment*: It argues that "ISPs are neglecting investments in low-income areas and communities of color," and that "broadband investments are bypassing areas that combine poverty and a relatively large share of Black residents."[34]
- *The Annenberg study reports a lack of broadband competition in poorer/Black Neighborhoods*: The paper states that "the odds of competition between two or more ISPs in a census block group are about 73% in areas with a small share of Black residents, dropping to about 62% (11 percentage points lower) in the traditional Black areas of LA County, and that "In low-income block groups, the odds of broadband competition are below 70%, climbing above 75% in the more affluent areas."[35] It also reports, "while the odds of broadband competition are higher and relatively similar in affluent areas regardless of the share of Black residents, the odds fall rapidly in poor communities as the share of Black residents increases."[36]
- *The Annenberg study states that between 2014 – 2017, the number of broadband service providers have declined in LA County*: The paper states, "about 1.1 million residents in LA County experienced a decline in the number of Internet choices" and "In addition, the share of census blocks covered by three or more ISPs dropped by almost half."[37]

A. No Evidence of "Cherry Picking" in LA County

The concept of "cherry-picking" or alternatively "cream-skimming" is an economic one. It refers to the phenomenon where a firm targets only high value customers, and its rivals are left with lower valued customers and suffer negative profit consequences.[38] It is a subtler concept than simply accusing a company of going after the most profitable customers, as the Annenberg study uses this term. Nevertheless, the patterns of broadband deployment in LA County suggest that

[33] Annenberg Study, pp. 1, 4.

[34] Annenberg Study, pp. 1, 4.

[35] Annenberg Study, pp. 2, 3.

[36] Annenberg Study, pp. 4.

[37] Annenberg Study, pp. 1.

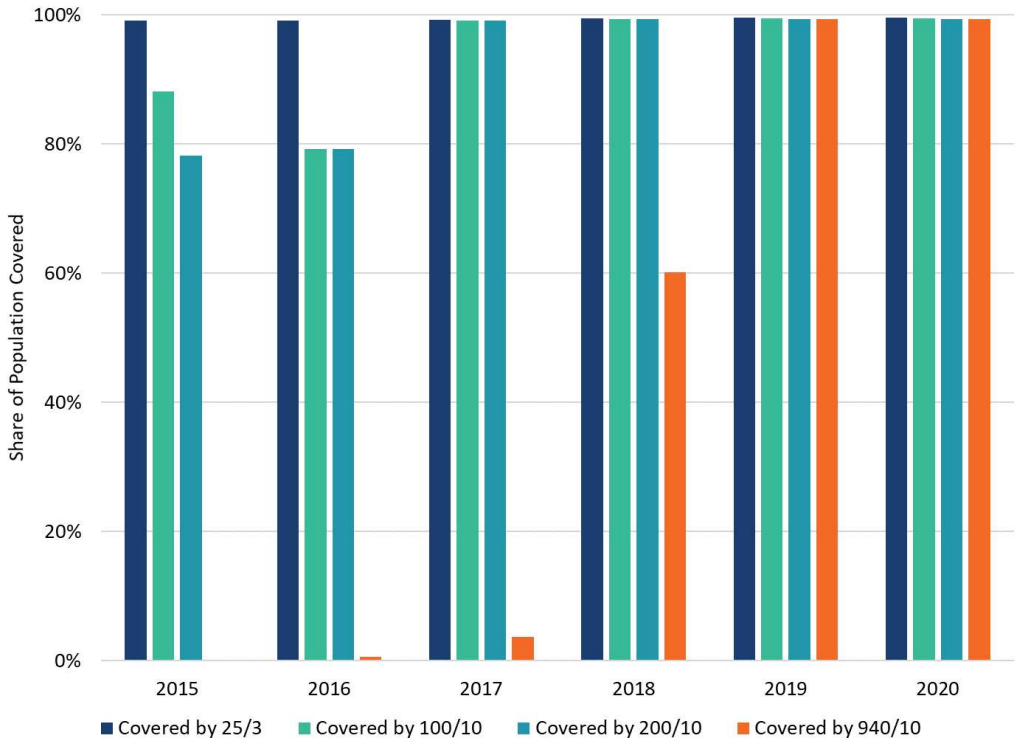
[38] Alfred E. Kahn, The Economics of Regulation: Principles and Institutions, p. 223. (John Wiley & Sons Inc., Volume II, 1971) (1988). See also, Coleman Bazelon, "Cream Skimming," Conference Research Paper, TPRC 2007, August 15, 2007, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2118250.

deployment decisions are driven primarily by population density and, regardless, broadband service is deployed to the vast majority of Angelinos.

1. No Evidence of "Cherry-Picking" in LA County at Market Level

Figure 4, below, shows the progression of coverage at various levels of service. It shows the share of population covered at various speed thresholds from 2015 - 2020. We find that since 2015, coverage at near gigabit speeds has become nearly ubiquitous with this speed tier being deployed to almost 100% of the population in LA County.[39]

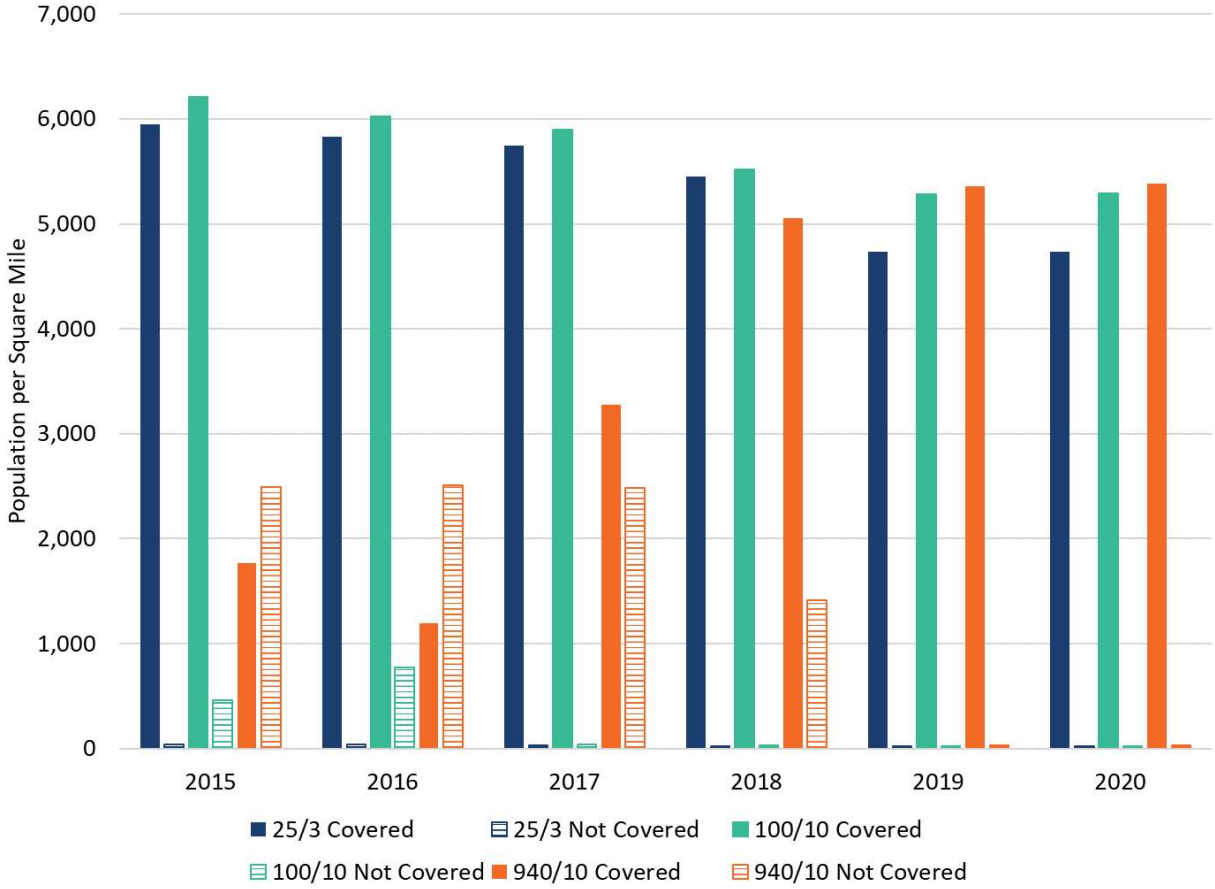
FIGURE 4: LA COUNTY SHARE OF POPULATION COVERED BY LEVEL OF SERVICE, 2015 - 2020



To better understand how various demographic and socio-economic factors are associated with this increase in overall coverage we use Figure 5-8 below. In Figure 5 we plot the density of the covered and uncovered blocks at each speed tier, and show how the population density of covered and uncovered areas has changed since 2015.

[39] We begin the analysis in 2015 because that is oldest version of the FCC data on which we rely. This figure and those that follow rely upon the same sources as Table 4. Also note that this corresponds to the yellow shaded areas in Figure 3.

FIGURE 5: LA COUNTY POPULATION DENSITY OF COVERED AND UNCOVERED POPULATION BY LEVEL OF SERVICE, 2015 - 2020



Note: The vertical axis shows the population density. The striped bars show the density in uncovered blocks and the solid bars show the density in covered blocks. The colors denote service tier levels. The percentage of uncovered population is less than 1 percent of the LA County population even at near gigabit speeds in 2020.

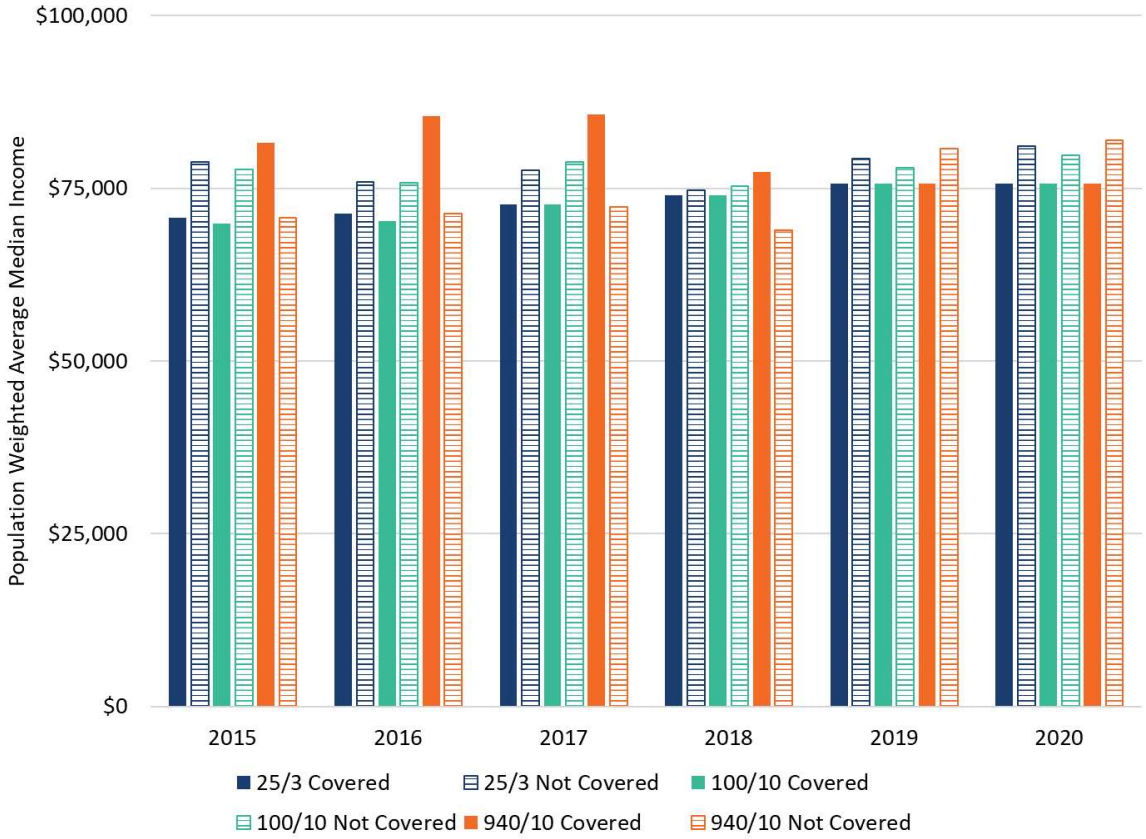
For example, in 2015, covered census blocks had a population density around 6,000 people per square mile, whereas uncovered census blocks had a population density well below 250 people per square mile at all speed levels, and the same pattern is displayed for say the near gigabit speed tier from 2017.[40] Additionally, the figure shows that lower speed tiers, such as 25/3 Mbps can be sustained at lower levels of density while a gigabit tier is deployed at a higher density level implying that providers have upgraded their networks in high population density areas first. For example, in 2020, the density of census blocks with 25/3 Mbps service is less than 5000 pop/ square mile, while those with a near gigabit cover have densities above 5000 pops/square mile.

[40] In the early days of the near gigabit speed tier deployment, the areas covered by gigabit speed have a lower density of population compared to areas not covered at that level of service.

The figures that follow can be interpreted in the same way; the metrics are reflective of the represented group of census blocks.

Figure 6 shows how income of covered and uncovered areas has progressed since 2015.[41]

FIGURE 6: LA COUNTY MEDIAN INCOME OF COVERED AND UNCOVERED POPULATION BY LEVEL OF SERVICE, 2015 – 2020



Note: The vertical axis shows the median income. The striped bars show the median income in uncovered blocks and the solid bars show the median income in covered blocks. The colors denote service tier levels. The percentage of uncovered population is less than 1 percent of the LA County population even at near gigabit speeds in 2020.

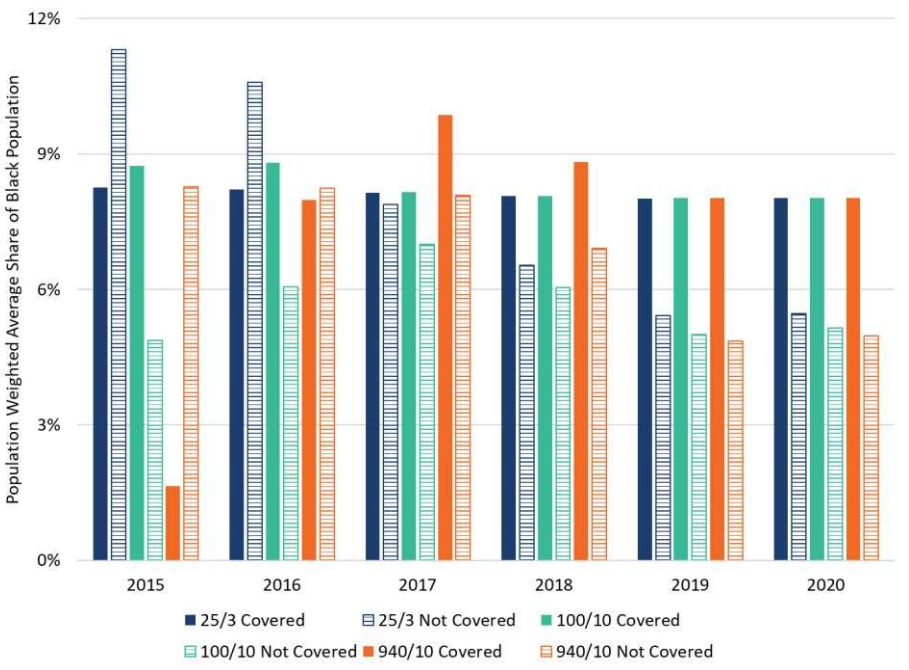
We measure income by the weighted average median income of the blocks at a certain speed tier. Again, contrary to the idea on entering richer neighborhoods first, the average income or uncovered blocks (the lined bars) are greater than that of covered blocks (solid bars). Additionally, the gap in income between covered and uncovered areas has increased since 2015, implying that as providers build out to densely populated areas it is relatively wealthier rural areas that are left

[41] Note that the income measures are all in 2019 dollars.

uncovered.[42] Maps of uncovered areas in Los Angeles County, Figure A2 and Figure A3 accentuate this point.

Figure 7 and Figure 8 show the progression in coverage by racial/ethnic composition for Black and Hispanic/Latina population respectively. From Figure 7 we observe that in 2015, the share of Black population in uncovered areas was greater than the share of the Black population in covered areas, but by 2017, this trend had started reversing with a much lower percentage of the Black population in uncovered blocks than the covered ones in 2020. This figure shows that the racial disparity in broadband deployment the Annenberg study found based on 2014 – 2017 data has gone away in recent years.[43]

FIGURE 7: LA COUNTY SHARE OF BLACK POPULATION IN COVERED AND UNCOVERED AREAS BY LEVEL OF SERVICE, 2015 - 2020



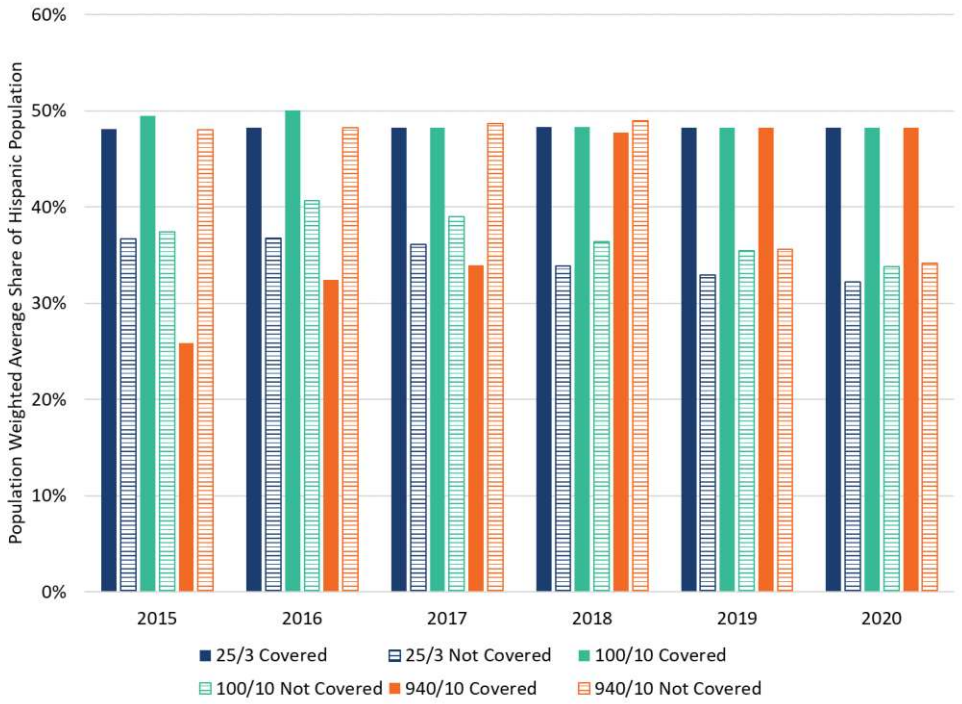
Note: The vertical axis shows the share of Black population. The striped bars show the share of Black population in uncovered blocks and the solid bars show the share of Black population in covered blocks. The percentage of uncovered population is less than 1 percent of the LA County population even at near gigabit speeds in 2020.

[42] For the near gigabit speed tier, in the very early days of deployment income appears to play a role, while in later years (2019-2020), the income patterns mirror other tiers with uncovered areas having high incomes. Combining this with Figure 5, it appears that in the early days of deployment the near gigabit tier was deployed to high-income low-density areas. However, this trend reversed itself in later years as the technology matured.

[43] The Annenberg study performed an econometric analysis based on 2014-2017 data. We report aggregate statistics in this paper based on more recent data spanning 2015 -2020. We have not replicated their analysis and cannot definitely say what their approach would show with the updated data. We can say, however, that their results are at such odds with the current data that their analysis would need to be replicated and scrutinized before relying on it.

Figure 8 shows that since 2015, the share of Hispanic/Latina population in uncovered areas has been lower than the share of Hispanic/Latina population in covered areas (except for the gigabit tier in the early years), and it is worth noting that the gap between those two measures continues to grow, and there is a lower share of Hispanic/Latina population in uncovered areas over the years.

FIGURE 8: LA COUNTY SHARE OF HISPANIC/LATINA POPULATION IN COVERED AND UNCOVERED AREAS BY LEVEL OF SERVICE, 2015 - 2020



Note: The vertical axis shows the share of the Hispanic/Latina population. The striped bars show the share of Hispanic/Latina population in uncovered blocks and the solid bars show the share of Hispanic/Latina population in covered blocks. The percentage of uncovered population is less than 1 percent of the LA County population even at near gigabit speeds in 2020.

In the Appendix, Figures A4, A5, A6, and A7 make up a collection of maps that show the layout of the demographic indicators across Los Angeles County compared to the county's service in 2020. These provide a visual representation of the figures above and disprove any evidence of "cherry-picking" by ISPs. Speed upgrades over time do not appear to have a racial/ethnic component to them.

2. Charter Did Not Engage in "Cherry-Picking"

Charter plays a key role in the Los Angeles County's competitive broadband landscape. As seen from Table 2, it provides nearly ubiquitous coverage, serving 98.3% of the population and at near

gigabit speeds, well above the FCC's definition of broadband and above the CPUC's goal of 100 Mbps download speed. Similar to the trends in the market described above in Table 1, Charter's coverage is driven by the population density of the underlying areas. The trends noted above are even more noticeable in Charter's network deployment. The difference in median income between covered and uncovered areas is greater for Charter than it is for the overall market, with uncovered areas having greater income and significantly lower densities that covered areas.

TABLE 2: STATE OF BROADBAND IN LA COUNTY BY PROVISION OF SERVICE BY CHARTER EXCLUSIVELY 2020

County Averages	Count of Blocks	Share of Blocks	Sum of Population	Share of Population	Population Weighted Median Income	Population Density (Pops / Sq. Mi)	Population Weighted Share of Hispanic Population (%)	Population Weighted Share of Black Population (%)
	109,582	100.0%	10,039,107	100.0%	$75,662	2,474	48.2%	8.0%
At Least 200 Mbps Download / 10 Mbps Upload								
Speeds Provided?	Count of Blocks	Share of Blocks	Sum of Population	Share of Population	Population Weighted Median Income	Population Density (Pops / Sq. Mi)	Population Weighted Share of Hispanic Population (%)	Population Weighted Share of Black Population (%)
Yes	96,959	88.5%	9,872,134	98.3%	$75,078	5,479	48.5%	8.1%
No	12,623	11.5%	166,973	1.7%	$111,723	74	27.4%	3.7%
At Least 940 Mbps Download / 10 Mbps Upload								
Speeds Provided?	Count of Blocks	Share of Blocks	Sum of Population	Share of Population	Population Weighted Median Income	Population Density (Pops / Sq. Mi)	Population Weighted Share of Hispanic Population (%)	Population Weighted Share of Black Population (%)
Yes	96,934	88.5%	9,867,413	98.3%	$75,072	5,479	48.6%	8.1%
No	12,648	11.5%	171,694	1.7%	$110,976	76	27.2%	3.8%

Sources: Form 477 June 2020, 2019 FCC estimates for Census Block Population, 2010 Census Block Area, ACS 2019 Estimates for median income, share of Black population, and share of Hispanic/Latina population.

Notes: Census block group demographic information is joined uniformly at the block level. Satellite providers are excluded. Weighted averages weight census block group demographic information at the census block by 2019 population of census block.

Charter provides at least 200 Mbps download / 10 Mbps upload everywhere it provides service.

Residents of Charter's uncovered areas have income well above that of residents of the average 200/10 Mbps uncovered areas for the market in general ($111K versus $82K from Table 1). Likewise, the share of Hispanic/Latina and Black population in Charter's uncovered areas is well below the average share of those populations in 200/10 Mbps uncovered areas for the overall market. Collectively, these analyses demonstrate that Charter's deployment has been nearly ubiquitous, of high quality, and consistent across all populations in terms of racial and ethnic composition.

Figure 9 shows the percentage of population covered by Charter at 25/3 Mbps and the near gigabit speed tier.

FIGURE 9: LA COUNTY POPULATION COVERAGE BY CHARTER LEVEL OF SERVICE, 2017 - 2020

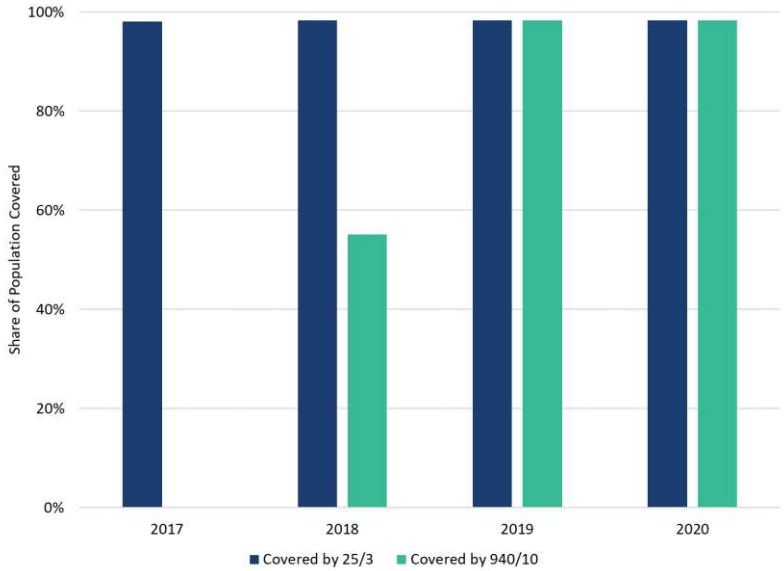
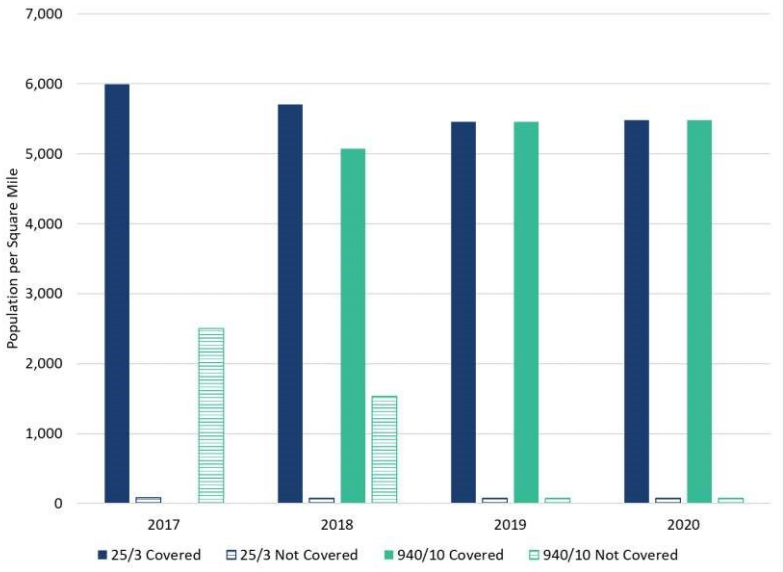


Figure 10 shows that Charter has deployed incremental network upgrades consistent with the economic foundations for building a network, and have upgraded their service nearly ubiquitously to near Gig service or above. They have added service in the more densely populated areas that they did not previously cover.

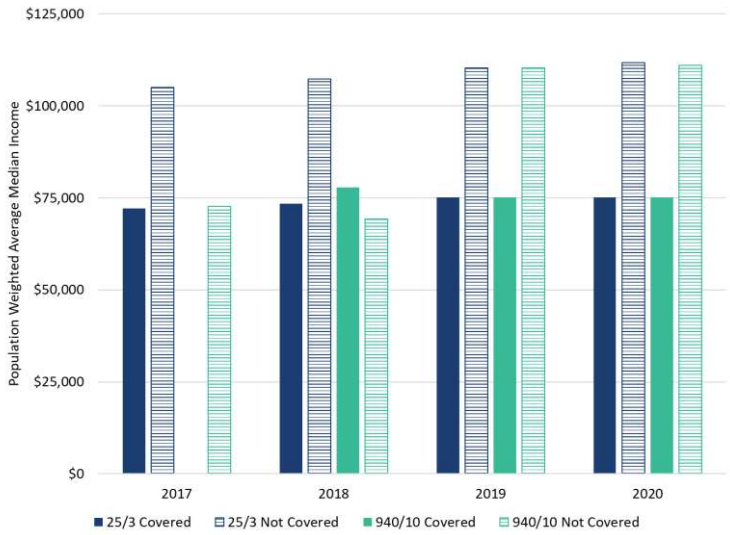
FIGURE 10: LA COUNTY POPULATION DENSITY BY CHARTER LEVEL OF SERVICE, 2017 - 2020



Note: The vertical axis shows the population density. The striped bars show the density in uncovered blocks and the solid bars show the density in covered blocks. The colors denote service tier levels. The percentage of Charter's uncovered population is less than 2 percent of the LA County population even at near gigabit speeds in 2020.

Figure 11, Figure 12, and Figure 13 show how Charter's deployment has progressed since 2017, when it began offering 200/10 Mbps nearly everywhere in Los Angeles County. Consequently, given the geographic distribution of income in Los Angeles County, Figure 11 shows that the income of those that they do not provide service to has increased more than it has for those they do to whom they do provide service.

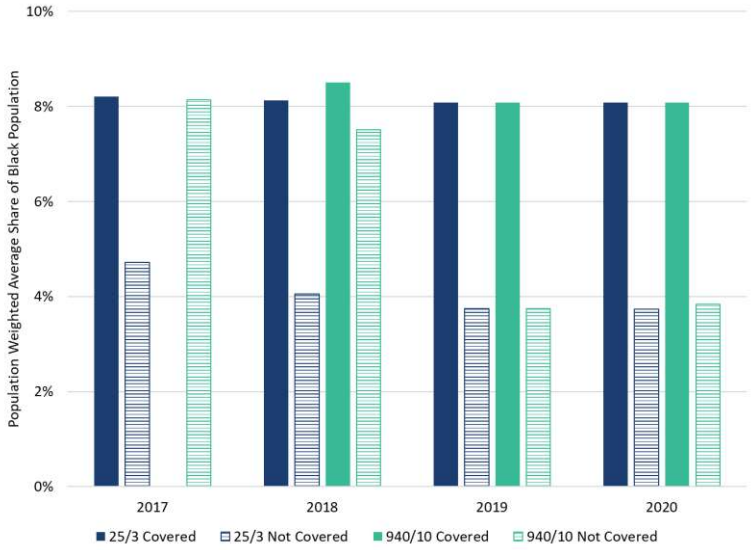
FIGURE 11: LA COUNTY MEDIAN INCOME BY CHARTER LEVEL OF SERVICE, 2017 - 2020



Note: The vertical axis shows the median income. The striped bars show the median income in uncovered blocks and the solid bars show the median income in covered blocks. The colors denote service tier levels. The percentage of Charter's uncovered population is less than 2 percent of the LA County population even at near gigabit speeds in 2020.

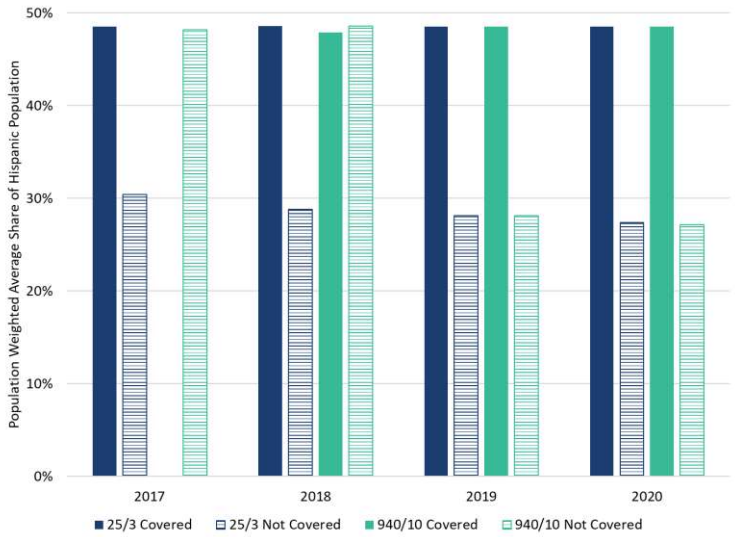
Figure 12 and Figure 13 show that the share of Black and Hispanic/Latina population in their uncovered areas is consistently below that of covered areas in recent years, similar to the finding for all providers, further reinforcing the fact that there is no systematic relationship between racial/ethnic factors and deployment.

FIGURE 12: LA COUNTY SHARE OF BLACK POPULATION BY CHARTER LEVEL OF SERVICE, 2017 - 2020



Note: The vertical axis shows the share of Black population. The striped bars show the share of Black population in uncovered blocks and the solid bars show the share of Black population in covered blocks. The percentage of Charter's uncovered population is less than 2 percent of the LA County population even at near gigabit speeds in 2020.

FIGURE 13: LA COUNTY SHARE OF HISPANIC/LATINA POPULATION BY CHARTER LEVEL OF SERVICE, 2017 - 2020



Note: The vertical axis shows the share of the Hispanic/Latina population. The striped bars show the share of Hispanic/Latina population in uncovered blocks and the solid bars show the share of Hispanic/Latina population in covered blocks. The percentage of Charter's uncovered population is less than 2 percent of the LA County population even at near gigabit speeds in 2020.

B. Number of Competitors or Fiber Presence is Not a Good Proxy for Investment in LA County

The Annenberg study uses broadband competition and availability of fiber as proxies for Investment. When discussing the digital divide and potential lack of investment in areas that lack adequate broadband service, it is unnecessary and misleading to use the number of providers or the presence of fiber as an indicator of broadband investment, as the Annenberg study has done.[44] In theory, there are three issues here. First, deployment and upgrade of a broadband network is a direct measure of investment and no proxy is needed to measure this. Second, from the performance indicators, it is clear that in a majority of cases, especially in terms of speeds offered, HFC and fiber are seen as substitutes.[45] An obvious implication is that if the presence or absence of a certain type of provider or the count of providers were to be used as a proxy for broadband investment then at the very least, cable and HFC providers should be counted along with the fiber providers – and doing so would dramatically change the results. Third, using the presence of fiber providers as a broad investment proxy misses the investment by other fixed providers.[46] For example, in areas where fixed wireless is available, such investment should also be counted when quantifying broadband investment in an area.

In practice, when a variable is used as a proxy, it needs to be well correlated with the underlying variable it is attempting to proxy for.[47] From the data and maps described earlier in the paper, it is quite clear from the number of competitors/fiber presence and investment are not well correlated. For instance, we find that Charter has ubiquitously upgraded its network for near Gig service across its service area, irrespective of the number of competitors or presence of a fiber competitor, implying that investment in its network is independent of the number of competitors/fiber presence. Therefore, if these proxies were used, the data would undercount investment in areas where there are fewer competitors or an absence of fiber. However, these proxies are unnecessary as we have direct measures of the variables of interest – the quality of broadband available.

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[44] Annenberg Study, pp. 1, 4.

[45] Cable Labs, "Driving Gigabit Speeds: From Lab to Consumer,' Fall 2018, accessed July 1, 2021, https://www.cablelabs.com/insights/driving-gigabit-speeds-from-lab-to-consumer.

[46] Intrado, "The 5G fixed wireless access market was valued at USD 503 million in 2020 and is expected to reach USD 86,669 billion by 2026, at a CAGR of 135.9% from 2020 to 2026," accessed July 1, 2021, https://www.globenewswire.com/news-release/2020/11/11/2124518/0/en/The-5G-fixed-wireless-access-market-was-valued-at-USD-503-million-in-2020-and-is-expected-to-reach-USD-86-669-billion-by-2026-at-a-CAGR-of-135-9-from-2020-to-2026.html.

[47] Marc F. Bellemare, "Metrics Monday: Proxy Variables," June 28, 2015, accessed July 1, 2021, https://marcfbellemare.com/wordpress/11115.

C. Recent Data Does Not Show Lack of Broadband Competition in Black or Hispanic Neighborhoods

The Annenberg study also reports a lack of broadband competition in poorer/Black Neighborhoods. Table 3, below, reports the same statistical metrics as Table 1, but breaks out the analysis by the number of providers at each level of service.

TABLE 3: STATE OF BROADBAND IN LA COUNTY BY LEVEL OF SERVICE AND BY PROVIDER COUNT 2020

County Averages	Count of Blocks	Share of Blocks	Sum of Population	Share of Population	Population Weighted Median Income	Population Density (Pops / Sq. Mi)	Population Weighted Share of Hispanic Population (%)	Population Weighted Share of Black Population (%)
	109,582	100.0%	10,039,107	100.0%	$75,662	2,474	48.2%	8.0%
At Least 25 Mbps Download / 3 Mbps Upload								
Number of Providers	Count of Blocks	Share of Blocks	Sum of Population	Share of Population	Population Weighted Median Income	Population Density (Pops / Sq. Mi)	Population Weighted Share of Hispanic Population (%)	Population Weighted Share of Black Population (%)
0	10,656	9.7%	47,094	0.5%	$81,079	24	32.2%	5.5%
1	35,273	32.2%	1,802,786	18.0%	$76,939	1,866	52.4%	8.1%
2	49,364	45.0%	5,903,988	58.8%	$76,303	6,764	50.6%	7.7%
3+	14,289	13.0%	2,285,239	22.8%	$72,903	8,460	39.0%	8.8%
At Least 100 Mbps Download / 10 Mbps Upload								
Number of Providers	Count of Blocks	Share of Blocks	Sum of Population	Share of Population	Population Weighted Median Income	Population Density (Pops / Sq. Mi)	Population Weighted Share of Hispanic Population (%)	Population Weighted Share of Black Population (%)
0	11,167	10.2%	56,607	0.6%	$79,796	26	33.8%	5.2%
1	41,352	37.7%	2,385,474	23.8%	$77,335	2,735	51.8%	8.2%
2	45,118	41.2%	5,670,082	56.5%	$75,707	7,159	49.7%	7.7%
3+	11,945	10.9%	1,926,944	19.2%	$73,357	8,644	39.5%	8.8%
At Least 200 Mbps Download / 10 Mbps Upload								
Number of Providers	Count of Blocks	Share of Blocks	Sum of Population	Share of Population	Population Weighted Median Income	Population Density (Pops / Sq. Mi)	Population Weighted Share of Hispanic Population (%)	Population Weighted Share of Black Population (%)
0	11,534	10.5%	63,880	0.6%	$82,353	29	34.4%	5.0%
1	71,207	65.0%	6,074,366	60.5%	$78,549	4,354	50.4%	7.4%
2	22,999	21.0%	3,305,521	32.9%	$69,925	8,410	47.1%	8.2%
3+	3,842	3.5%	595,340	5.9%	$77,454	9,217	33.2%	13.4%
At Least 940 Mbps Download / 10 Mbps Upload								
Number of Providers	Count of Blocks	Share of Blocks	Sum of Population	Share of Population	Population Weighted Median Income	Population Density (Pops / Sq. Mi)	Population Weighted Share of Hispanic Population (%)	Population Weighted Share of Black Population (%)
0	11,551	10.5%	65,713	0.7%	$81,964	30	34.2%	5.0%
1	85,175	77.7%	8,126,424	80.9%	$77,189	5,151	46.8%	7.4%
2	12,744	11.6%	1,827,834	18.2%	$68,443	6,875	55.0%	11.0%
3+	112	0.1%	19,136	0.2%	$92,624	2,229	34.2%	6.3%

Sources: Form 477 June 2020, 2019 FCC estimates for Census Block Population, 2010 Census Block Area, ACS 2019 Estimates for median income, share of Black population, and share of Hispanic/Latina population.

Notes: Census block group demographic information is joined uniformly at the block level. Satellite providers are excluded. Weighted averages weight census block group demographic information at the census block by 2019 population of census block.

Again, competition appears to be driven by population density. In this table, we show that density is both a driver of competition (*e.g.* as the population density of an area increases so too does the number of providers) and a driver of higher speeds (*e.g.* as density increases, so too does the average speed advertised). At all levels of service illustrated in the table, population density doubles (at a minimum) when the number of providers increases from 1 to 2 or more. Over 80% of the population has 25/3 Mbps provided by at least 2 providers. There does not appear to be any correlation between the racial/ethnic composition of LA County and the number of competitors.

D. Explaining Changes in the Number of Providers in LA County

As stated earlier, the Annenberg study documents loss of providers for a certain percentage of the LA county population and infers this implies declining broadband investment. To explore this finding we isolate census blocks for which year over year the number of providers changed at 25/3 Mbps. Then, similar to the table above, we summarize demographic indicators to see if trends exist with respect to the characteristics of blocks that saw increases and decreases in the number of providers. Table 4 reports these statistics.

TABLE 4: ANALYSIS OF CHANGE OF NUMBER OF PROVIDERS IN LA COUNTY AT 25/3 MBPS

County Averages by Year	Count of Blocks	Share of Blocks	Sum of Population	Share of Population	Population Weighted Median Income	Population Density (Pops / Sq. Mi)	Population Weighted Share of Hispanic Population (%)	Population Weighted Share of Black Population (%)
2016	109,582	-	10,131,032	-	$71,394	2,497	48.1%	8.2%
2017	109,582	-	10,163,482	-	$72,753	2,505	48.2%	8.1%
2018	109,582	-	10,105,518	-	$74,032	2,490	48.2%	8.1%
2019	109,582	-	10,039,107	-	$75,662	2,474	48.2%	8.0%
2020	109,582	-	10,039,107	-	$75,662	2,474	48.2%	8.0%
Blocks with Year over Year Increase in Number of Providers								
Year	Count of Blocks	Share of Blocks	Sum of Population	Share of Population	Population Weighted Median Income	Population Density (Pops / Sq. Mi)	Population Weighted Share of Hispanic Population (%)	Population Weighted Share of Black Population (%)
2016	25,941	23.7%	3,337,068	32.9%	$69,635	7,310	45.2%	9.0%
2017	11,522	10.5%	1,349,512	13.3%	$71,419	4,656	47.1%	8.4%
2018	3,296	3.0%	439,289	4.3%	$60,329	2,600	58.0%	12.9%
2019	18,133	16.5%	1,973,831	19.7%	$70,156	3,629	44.9%	6.8%
2020	10,889	9.9%	1,533,785	15.3%	$74,461	6,764	39.0%	11.3%
Blocks with Year over Year Decrease in Number of Providers								
Year	Count of Blocks	Share of Blocks	Sum of Population	Share of Population	Population Weighted Median Income	Population Density (Pops / Sq. Mi)	Population Weighted Share of Hispanic Population (%)	Population Weighted Share of Black Population (%)
2016	4,501	4.1%	491,522	4.9%	$67,836	6,183	51.6%	7.9%
2017	3,646	3.3%	543,669	5.3%	$64,661	7,015	41.6%	8.2%
2018	3,128	2.9%	152,769	1.5%	$75,067	2,801	49.8%	7.3%
2019	2,563	2.3%	135,375	1.3%	$82,841	2,112	44.4%	6.8%
2020	1,885	1.7%	76,089	0.8%	$75,213	1,252	34.6%	7.8%
Blocks with Year over Year Static Number of Providers								
Year	Count of Blocks	Share of Blocks	Sum of Population	Share of Population	Population Weighted Median Income	Population Density (Pops / Sq. Mi)	Population Weighted Share of Hispanic Population (%)	Population Weighted Share of Black Population (%)
2016	79,140	72.2%	6,302,442	62.2%	$72,607	1,790	49.4%	7.9%
2017	94,414	86.2%	8,270,301	81.4%	$73,507	2,241	48.8%	8.1%
2018	103,158	94.1%	9,513,460	94.1%	$74,645	2,481	47.8%	7.8%
2019	88,886	81.1%	7,929,901	79.0%	$76,910	2,299	49.1%	8.3%
2020	96,808	88.3%	8,429,233	84.0%	$75,883	2,236	50.0%	7.4%

Sources: Form 477 June 2015 - 2020, 2015 – 2019 FCC estimates for Census Block Population, 2010 Census Block Area, ACS 2015-2019 Estimates for median income, and share of Black population and share of Hispanic/Latina population.

Notes: Census block group demographic information is joined uniformly at the block level. Satellite providers are excluded. Weighted averages weight census block group demographic information at the census block by given year's population of census block.

One key observation is that the share of population in census blocks with an increase in the number of providers is significantly higher than the share of population in census blocks with a decrease in the number of providers. Additionally, by 2020, only 0.8% of LA County's population or less that 100K residents experience a loss of a provider. In addition, confirming earlier findings in this paper, we do not find any systematic trends that relate an increase or decrease in the number of providers to any of the demographic indicators. That is, racial/ethnic composition and

income do not appear to drive a provider's decision to add or remove service from a given census block.

V. Conclusion

Availability and adoption of broadband has increased significantly over the years. Usage and Internet traffic for both fixed and mobile broadband has exploded. On the deployment side, a significant portion of the U.S. population now have a choice of gigabit broadband service. These trends are expected to continue in the coming years. However, despite these overall tends certain areas and communities still lack adequate access to broadband and this gap in coverage is an increasing concern for policy makers. Before the pandemic, a large part of the focus was on the disparity in broadband availability and adoption in rural versus urban areas, *i.e.*, the rural-urban digital divide. The pandemic forced us to confront another reality – the intra-urban divide, where there were disparities in broadband penetration within urban areas. Rectifying both these digital connectivity gaps is a top priority for the federal and local governments.

The California Public Utilities Commission has solicited comments on the perceived disparities in fixed broadband coverage based on income and race, and has opened an inquiry into these issues. This paper focuses on California and particularly on Los Angeles County, and responds to the ALJ ruling and comments on the current state of broadband in LA County. We explain the economics of broadband deployment with its large sunk/fixed cost, a comparatively lower marginal cost and revenue expectations that would justify the large fixed investment, and how this economic reality may dictate a provider's actions in a market.

We find that density is the primary driver of broadband deployment, and income and socio-economic factors are of second-order importance or do not matter. For California, we find that areas that are not covered (*i.e.*, have speeds below 25/3 Mbps) are relatively more rural areas within the county and most have population densities below 10 people per square mile, and this rural-urban gap appears to be narrowing between 2015 and 2020. For LA County, we find that we find that 99.5% of the population in the county has broadband service of 25/3 Mbps. 99.4% of the population is covered by an improved 200/10 Mbps with a similar percentage of the population receiving near gigabit services. To the extent that some population remains uncovered, on average this is largely a function of very low population density.

Our finding do not support a “cherry-picking” explanation for disparity in coverage. Contrary to the idea of entering richer neighborhoods first, we find that as providers build out to densely populated areas; it is relatively wealthier rural areas that are left uncovered. We do not find any evidence of systematic differences in the share of Black or Hispanic/Latina population in covered and uncovered areas. In fact, we find that since 2015, the share of Black population in uncovered areas is lower than the share of Black population in uncovered areas in recent years. For the Hispanic/Latina population, the share of population in uncovered areas has always been lower than the share of population in covered areas. We do not find any evidence of cherry-picking by Charter and show that they have provided nearly ubiquitous coverage of LA County population at 200/10 Mbps and at near gigabit speeds, with no discernable income or racial/ethnic pattern of deployment and upgrade.

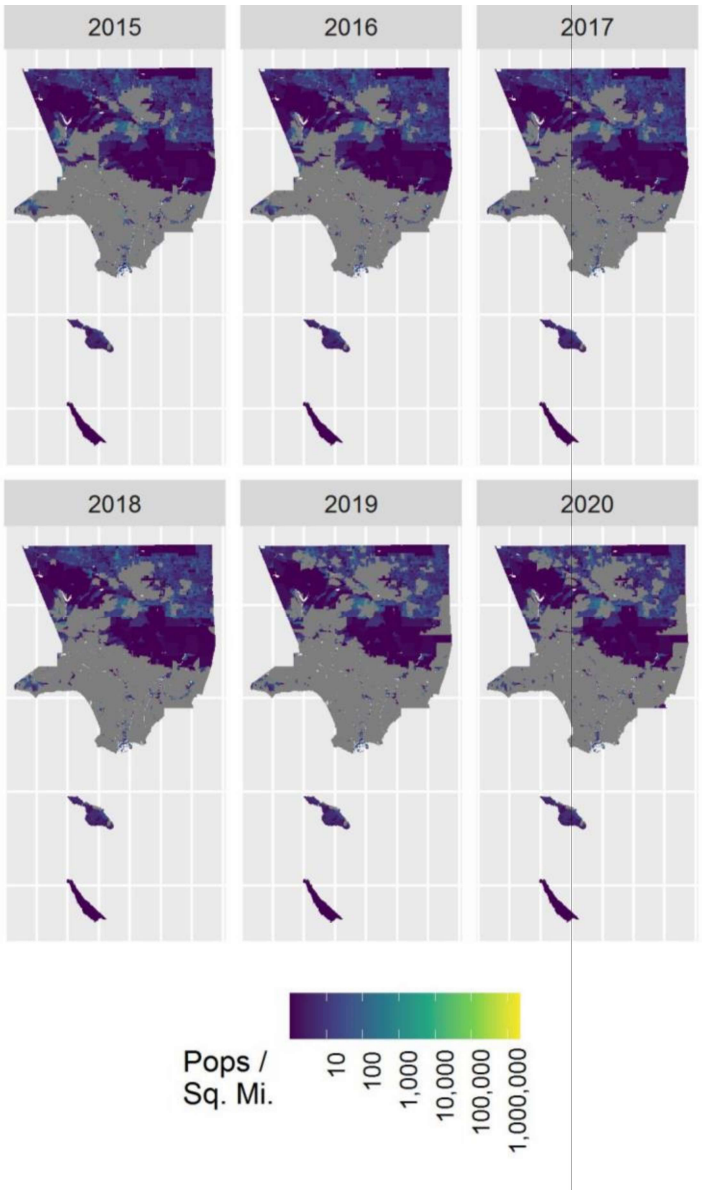
We also find that density is both a driver of competition (*e.g.*, as the population density of an area increases so too does the number of providers) and a driver of higher speeds (*e.g.*, as density increases, so too does the average speed advertised in LA County). Additionally, racial/ethnic composition and income do not appear to drive a provider’s decision to add or remove service from a given census block. We also explain why it is misleading to use the number of providers or the presence of fiber as an indicator of broadband investment, and argue that investment, as measured by deployment and upgrades is uncorrelated with the number of competitors or fiber presence as evident from Charter’s network map. Thus, if the ultimate policy goal is to increase investment by providers, using the presence of fiber or the number of competitors as a proxy for broadband investment provides a biased picture that may lead to biased incorrect policy solutions.

Appendix

FIGURE A1: LOS ANGELES COUNTY MAP

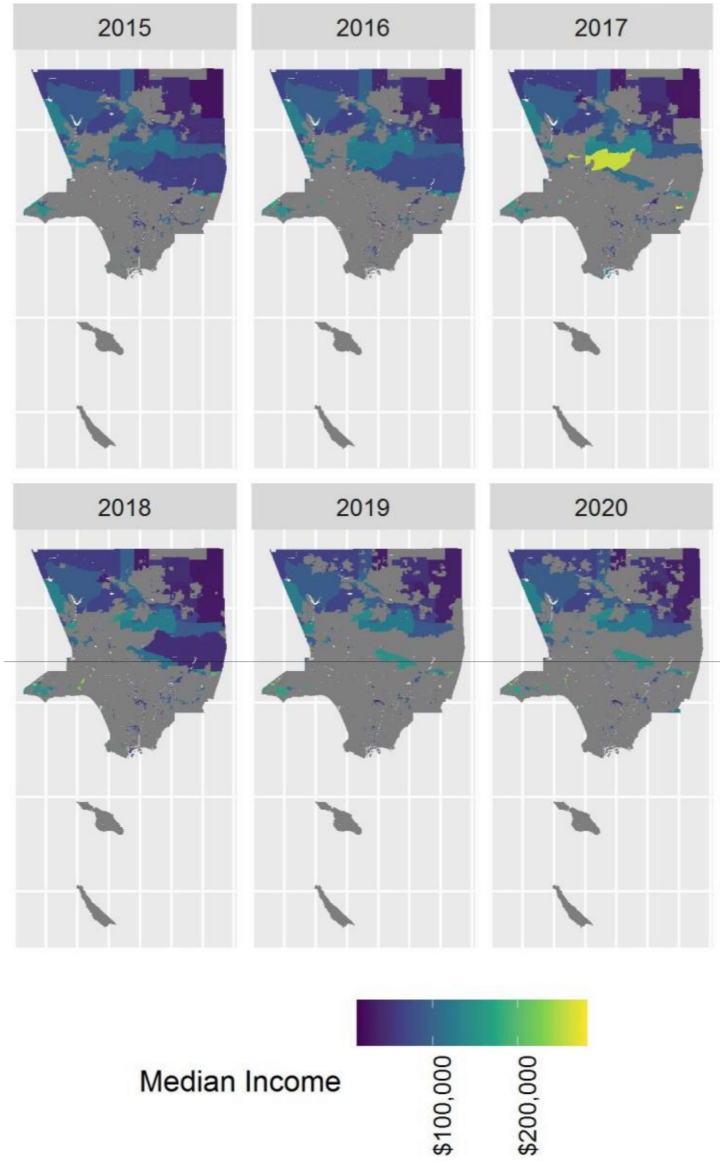
Source: See https://ontheworldmap.com/usa/city/los-angeles/los-angeles-county-map.html.

FIGURE A2: POPULATION DENSITY IN UNCOVERED BLOCKS AT 25/3 MBPS



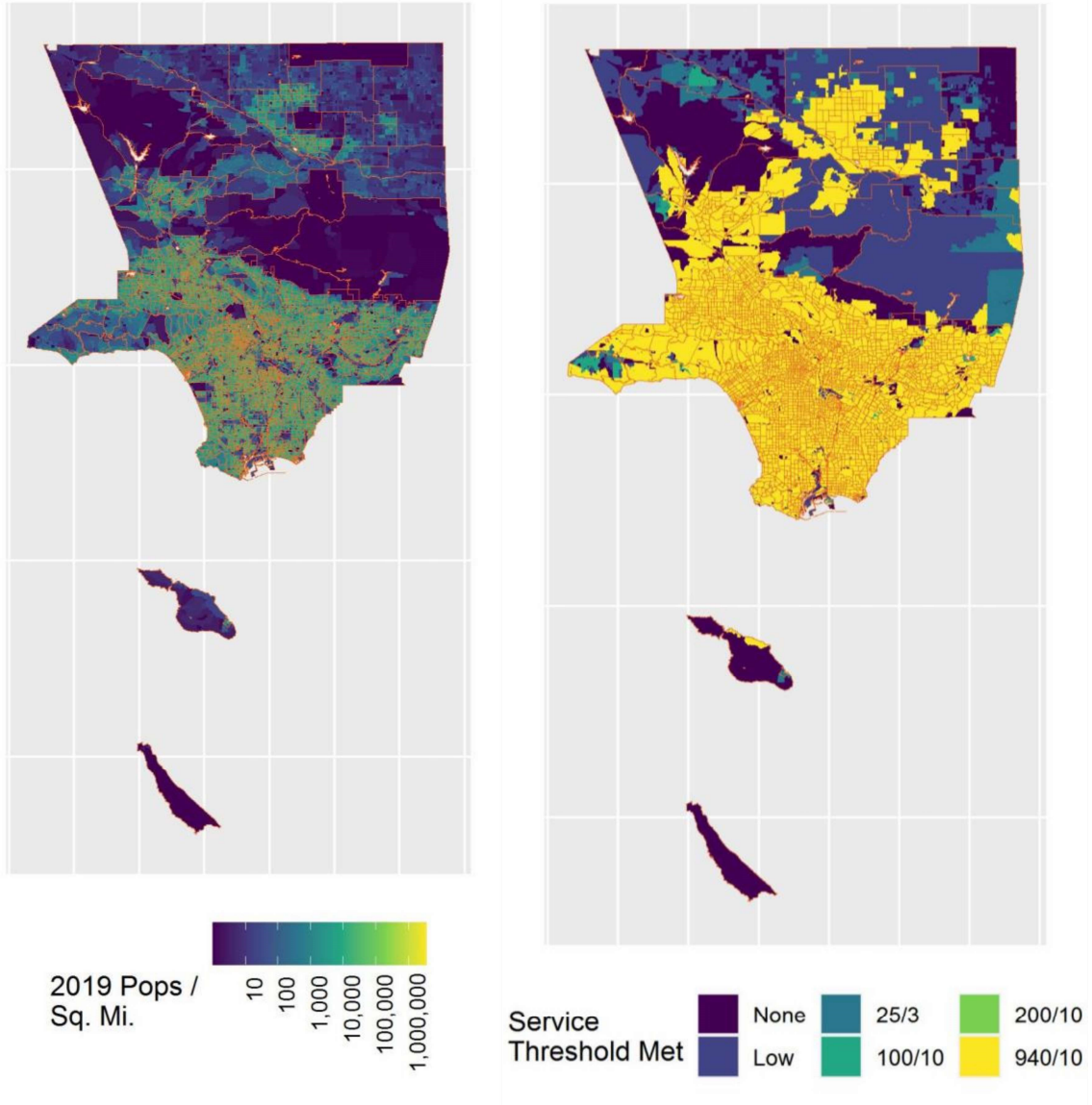
Sources: FCC Form 477; FCC Staff Block Population Estimates; US Census TIGER Files.
Notes: Census Blocks with only water area are excluded from the map.

FIGURE A3: MEDIAN INCOME IN UNCOVERED BLOCKS AT 25/3 MBPS



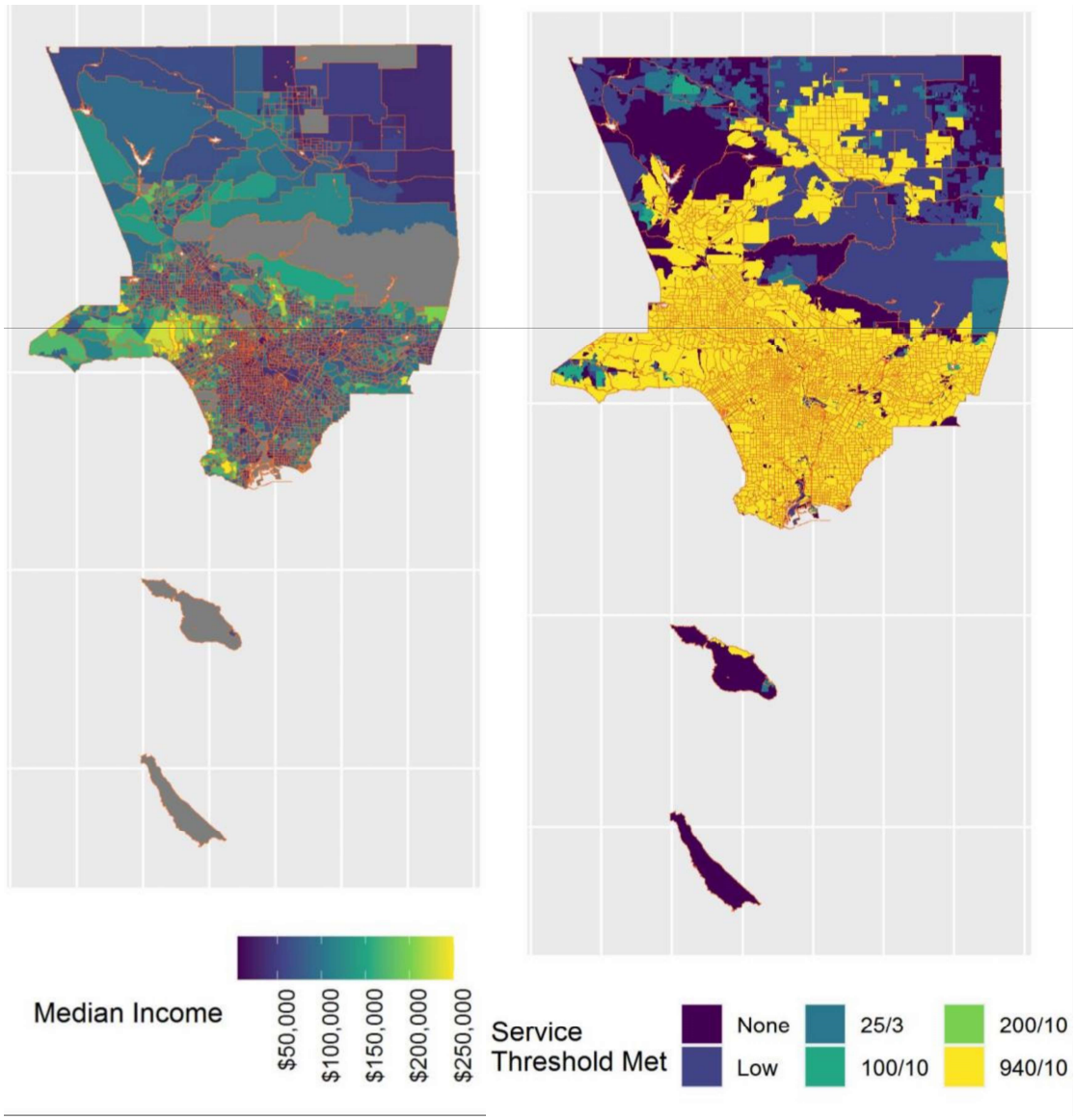
Sources: FCC Form 477; FCC Staff Block Population Estimates; US Census TIGER Files.
Notes: Census Blocks with only water area are excluded from the map.

FIGURE A4: LOS ANGELES COUNTY 2019 POPULATION DENSITY AND 2020 BROADBAND SERVICE



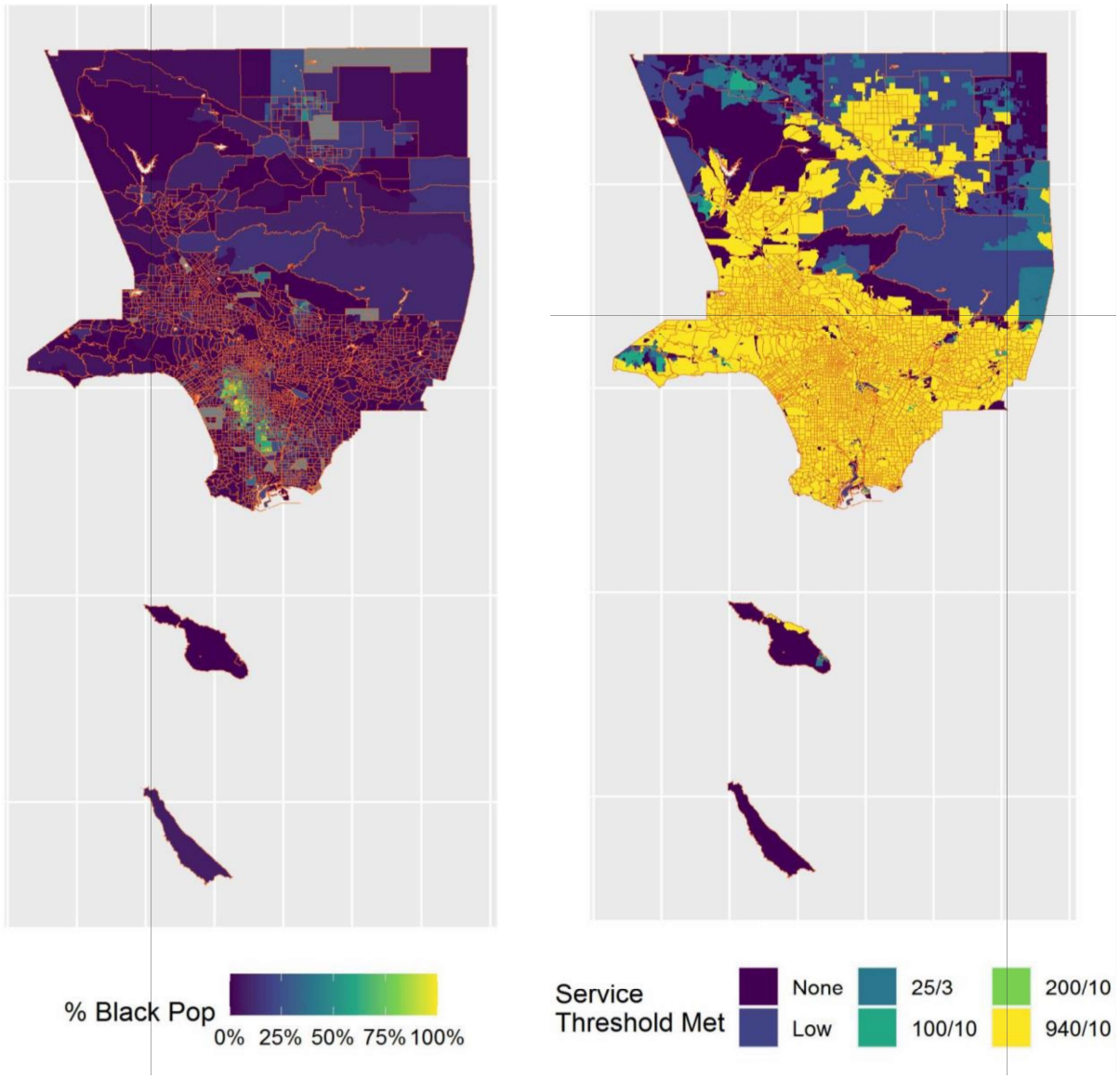
FCC Staff Block Population Estimates; US Census TIGER Files.
Notes: Orange borders show census tracts. Census Blocks with only water area are excluded from the map.

FIGURE A5: LOS ANGELES COUNTY 2019 MEDIAN INCOME AND 2020 BROADBAND SERVICE



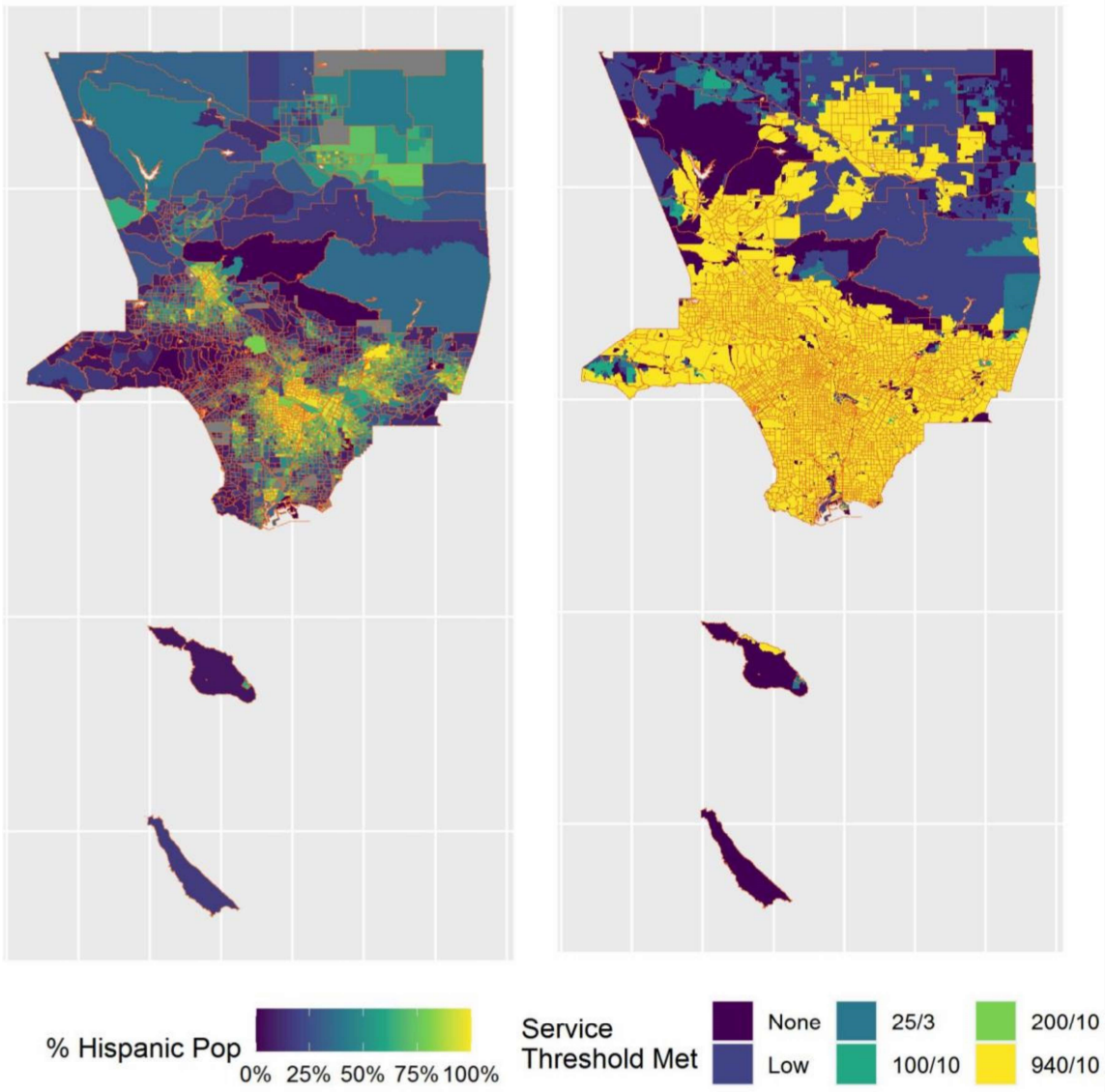
Sources: FCC Form 477; US Census ACS Data; US Census TIGER Files.
Notes: Orange borders show census tracts. Census Blocks with only water area are excluded from the map.

FIGURE A6: LOS ANGELES COUNTY 2019 BLACK POPULATION AND 2020 BROADBAND SERVICE



Sources: FCC Form 477; US Census ACS Data; US Census TIGER Files.
Notes: Orange borders show census tracts. Census Blocks with only water area are excluded from the map.

FIGURE A7: LOS ANGELES COUNTY 2019 HISPANIC/LATINA POPULATION AND 2020 BROADBAND SERVICE

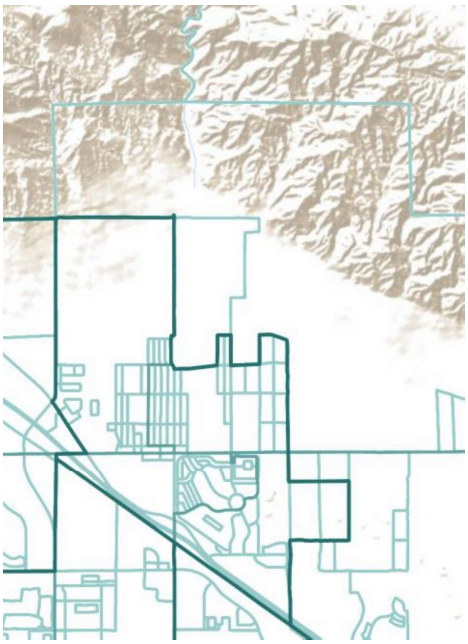


Sources: FCC Form 477; US Census ACS Data; US Census TIGER Files.
Notes: Orange borders show census tracts. Census Blocks with only water area are excluded from the map.

FIGURE A8: SELECTED AREA OF LA COUNTY SHOWING CENSUS BLOCKS

Source: US Census, "Geography Division." https://tigerweb.geo.census.gov/tigerweb/.
Note: Census Blocks are marked with faintest borders.

FIGURE A9: SELECTED AREA OF RIVERSIDE COUNTY CENSUS BLOCKS



Source: US Census, "Geography Division." https://tigerweb.geo.census.gov/tigerweb/.
Note: Census Blocks are marked with faintest borders.

EXHIBIT B

Declaration of Deborah Picciolo

DECLARATION OF DEBORAH PICCIOLO IN SUPPORT OF CHARTER FIBERLINK CA-CCO, LLC AND TIME WARNER CABLE INFORMATION SERVICES (CALIFORNIA), LLC'S OPENING COMMENTS ON THE ASSIGNED ADMINISTRATIVE LAW JUDGE'S MAY 28, 2021 RULING

In support of opening comments on the Assigned Administrative Law Judge's May 28, 2021 Ruling filed by Charter Fiberlink CA-CCO, LLC and Time Warner Cable Information Services (California), LLC, on behalf of its affiliates ("Charter"), I, Deborah Picciolo, hereby declare under penalty of perjury that, to the best of my knowledge, information, and belief, the following is true and correct:

1. I am Charter's Senior Vice President, Operations, and have been employed by Charter. My responsibilities include oversight of Charter's design, construction, maintenance, and operation of its plant in the field, including in California. My business address is c/o Charter Communications, 550 North Continental Boulevard, Suite 250, El Segundo, CA 90245.

2. Charter has constructed its facilities to support baseline speeds of 200 Mbps and up to gigabit service (with download speeds of up to 1 Gbps) to nearly all residential households within its California footprint. This includes support for 200 Mbps to 100% of its households with broadband availability in Los Angeles County, regardless of income or demographics.

3. To achieve these results, Charter's deployment of broadband facilities in California—including the construction and maintenance of its hybrid fiber coaxial ("HFC") network—required a major commitment of resources and a commitment to equitably serving county residents. Charter's efforts have included deployment in low-income, predominantly Hispanic communities in East Los Angeles, Maywood, Huntington Park, and others, and historically Black neighborhoods, includes Compton, Watts, and South Los Angeles—communities that Charter has served for decades, and with gigabit service available as of 2018.

4. Charter has used and continues to deploy fiber-to-the-premises ("FTTP") for certain portions of its network. In Charter's HFC network, for instance, fiber is used for the vital links from the headend or hub to the node, and Charter is in the process of planning a significant deployment of FTTP facilities where it is engaged in altogether new construction to unserved rural areas. In those cases, the company used FTTP, but in other cases, Charter has chosen to upgrade its HFC network to deliver more capacity and faster speeds.

5. FTTP is not always the most efficient or effective technology for making high-speed broadband service available, particularly in built-up markets where an HFC network is already present. In those markets, upgrading existing HFC facilities to enable higher speeds and lower latency is often the fastest and most efficient way to improve customer offerings.

6. In addition, the economic trade-offs of FTTP (much higher deployment costs, lower maintenance costs, less signal degradation, and less power consumption) make it well suited for some deployments but not others. This is due to factors unrelated to household income, including availability of power, whether construction is new, and the feasibility of accessing necessary infrastructure. In many markets, given the high deployment cost of fiber, the most practical way to increase broadband speeds is to upgrade existing HFC facilities. Charter's HFC facilities in Los Angeles County, for example, have been in place for decades, which made upgrading those facilities to support gigabit service the most efficient and cost effective approach in most instances.

7. Charter continues its efforts to expand its network to unserved areas in California, but in some instances, its planned deployments have encountered significant barriers. Notably, property managers have played a role in preventing deployments to unserved Californians. Charter has encountered many instances where property managers played a gate-keeping role and prevented Charter from accessing multi-dwelling units (MDUs) and mobile home parks. These

decisions leave residents of MDUs and mobile home parks without access to broadband (or choice between providers), even though the necessary facilities could be easily deployed.

Dated: July 1, 2021
El Segundo, CA

Respectfully submitted,

By: Deborah L. Picciolo
Deborah Picciolo
Senior Vice President, Operations